

MONTHLY WEATHER REVIEW,

AUGUST, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

GENERAL ORDERS }

No. 63. }

HEADQUARTERS OF THE ARMY,

ADJUTANT GENERAL'S OFFICE,

Washington, August 24, 1880.

The Secretary of War is pained to announce to the Army the death of Brigadier General ALBERT J. MYER, Chief Signal Officer U. S. Army, which took place at Buffalo, New York, this morning.

Entering the Army in 1854 as an Assistant Surgeon on the Texas frontier, where vast stretches of plain offer great facility for communication by vision, General MYER's attention was early turned to the subject of signaling by sight, in which he has since achieved such remarkable success; establishing that branch of the military service, during the late war, on a basis of usefulness and importance that has proved of the greatest benefit and caused its knowledge to become an important part of education, not only for the Army but also for the Navy. The Army is also largely indebted to his efforts for its telegraphic communication with posts on the extreme frontier; five thousand miles of electric telegraph lines having been built under his supervision.

Assigned by the Secretary of War, under the act of February 9, 1870, to the duty of taking meteorological observations and giving public notice of the approach and force of storms, with the assistance of our extensive telegraph system, for the benefit of commerce, he brought to bear remarkable ability for organizing and perfecting this service, and making its usefulness felt, not only in every sea-port but in every hamlet of the land. In this comparatively unexplored field of science and usefulness, General MYER displayed the enterprise of practical investigation and study of meteorology, with the production of useful results which has made his name familiar to every one of his countrymen, and proved of incalculable benefit to various interests. These services have been highly appreciated both at home and in foreign countries. His perseverance, energy and tact, resulting in establishing a uniform international system of simultaneous meteorological observations, affords to the world the only full and satisfactory data extant for the study of meteorology. Struck down at the meridian of his usefulness, the country has lost a most distinguished and promising officer, and the Signal Service an able, efficient and zealous chief.

The officers of the Signal Corps and on duty therewith will wear the usual badge of mourning for thirty days.

BY COMMAND OF GENERAL SHERMAN:

R. C. DRUM,

Adjutant General.

INTRODUCTION.

In preparing this REVIEW the following data, received up to September 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 143 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 147 monthly journals and 161 monthly means from the former, and 15 monthly means from the latter; reports from 25 Sunset stations; 211 monthly registers from Voluntary Observers; 16 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of the atmospheric pressure, as reduced to sea-level, for the month of August, 1880, over the United States and Canada is shown by isobaric lines on chart No. II. At a few out-lying stations the means are given in figures indicating English inches. The region of highest pressure is on the Atlantic coast and farther northward than usual, covering the coast from New Jersey to North Carolina instead of being confined to the South Atlantic States. The region of lowest pressures extends from Manitoba to southern Texas. On the Pacific coast the highest pressure is as usual in Oregon, while the lowest means are reported from the interior valleys.

Departures from the Normal Values for August.—The barometric means for August, 1880, when compared with the average for the past eight years, show marked and unusual departures. Over New England, the Middle Atlantic States, the Lake region, (except the southern half of Lake Michigan) the pressures range from .04 inch to .01 inch above the normal, being .07 above at Marquette, .09 at Albany and .10 at Burlington. The Gulf States, the Upper Mississippi valley, and the greater part of the Rocky Mountain region reported means slightly below the normal, the greatest deficiency being reported from Punta Rassa, .07 below the normal.

Barometric Ranges.—The local barometric ranges, reduced to sea-level, have been very unusual and irregular, especially in those parts of the Gulf States over which the cyclones of August 12th and 29th passed, where the following ranges were reported: Punta Rassa, 0.65; Indianola and Galveston, 0.45; Cedar Keys, 0.80; Pensacola, 0.81; Mobile, 0.84; Laredo, 1.09; Brownsville, 1.79. Ranges exceeding 0.90 are reported from the Red River of the North valley, from Burlington, Vt., and North Platte, Neb. The smallest ranges in the country were: Santa Fe, 0.24; Campo, 0.32; and Key West, 0.33.

Areas of High Barometer.—During the month of August, 1880, eight areas of high pressure prevailed within the limits of the Signal Service stations. Nos. II and VIII were slight encroachments of the area of high barometer from the Pacific ocean. The remaining areas were the usual out-flows of cold air moving southeastward from the Saskatchewan region. Area No. III was marked by the first frosts east of the Mississippi river.

No. I.—This area appeared in the Upper Missouri valley during the 1st; Bismarck barometer the morning of the 2nd 0.53 above the normal. During the 2nd and 3rd, the area although remaining central in the Missouri valley extended its influence over the entire country excepting the Eastern Gulf States. During the 4th it moved gradually eastward to the Lake region, where it remained central with slight changes of pressure until the 7th, during which day moving down the St. Lawrence valley it withdrew over the Gulf of St. Lawrence during the 8th. During the prevalence of this area occurred the minimum temperatures of the month over Lake Michigan, the Ohio valley, and for the entire region between the Mississippi river and the Rocky Mountains. On the afternoon of the 5th, Cautionary Signals were ordered for the North Carolina coast; they were lowered at midnight of the 6th, having been partly justified: maximum velocities, Cape Henry, N.E. 32; Chincoteague, N.E. 29, and Cape Lookout, S.W. 28.

No. II.—This area appeared on the North Pacific coast during the 7th, where it remained until the 16th, when it gradually dissipated. The highest barometer reading was at Olympia the afternoon of the 9th, 0.24 above the normal.

No. III.—During the 16th the barometer rose slowly over the Upper Lake region, and in the afternoon of the 11th Duluth barometer was 0.23 above the normal. The highest pressure was reported from Saugeen the afternoon of the 12th, 0.29 above the normal. During the 13th the area gradually dissipated. On the 13th Cautionary Signals were ordered from Kittyhawk northward to Delaware Breakwater and at Sandy Hook and Wood's Holl. These signals were changed to Off-shore on the afternoon of the 14th, and were lowered at midnight. The following maximum velocities were reported: Sandy Hook, N.W. 31; Cape May, W. 25; Wood's Holl, S.W. 25; Delaware Breakwater, S.W. 26.

No. IV.—During the 13th and 14th the barometer rose above the mean in the Northwest, and in the afternoon of the latter date it was 0.30 above the normal at Fort Garry. Moving slowly eastward with increasing pressure, it was central during the 16th over the Lower Lake region; Kingston barometer at midnight 0.54 above the normal. Moving down the valley of the St. Lawrence, the area withdrew eastward over the Atlantic ocean during the 18th. On the afternoon of the 17th, the

highest pressure of the area was reported from Father Point, 0.55 above the normal. During the passage of this area, the minimum temperatures of the month occurred in the greater part of the Lake region, and at most stations in New England and in the Middle Atlantic States. During the 16th and 17th, frequent frosts were reported from the interior of New England and New York, from northern Michigan and the Provinces of Ontario and Quebec.

No. V.—During the 23rd the barometer rose rapidly above the normal in the Lake region; afternoon barometer at Rockliffe 0.26 above the normal. The morning of the 24th the highest pressure was at Father Point, 0.29 above the normal; during the day the area dissipated or withdrew northeastward.

No. VI.—During the 23rd the pressure rose rapidly in the northwest and by the morning of the 24th the barometer at Fort Garry was 0.43 above the normal. Moving eastward, the area was central the morning of the 25th in Ontario. Withdrawing northeastward to the Canadian Maritime Provinces, the highest pressure of the area was reported on the morning of the 26th from Father Point. The pressure remained in those provinces nearly unchanged until the 27th, when the area dissipated or withdrew southeastward.

No. VII.—During the 28th the pressure increased in the Lake region; Rockliffe barometer at midnight 0.21 above the normal. During the 29th the pressure increased in the entire St. Lawrence valley, but the central area withdrew slowly northeastward to the Canadian Maritime Provinces, where it remained with pressure nearly unchanged at the end of the month. The highest pressure of the area was reported from Father Point the morning of the 30th, 0.46 above the normal.

No. VIII.—During the 29th the pressure in California rose considerably above the mean; Sacramento and Red Bluff barometers, at midnight, 0.14 above the normal. During the 30th and 31st, the pressure remained high in California and increased in the Northern Pacific coast region, where, at midnight of the 31st, the barometer at Olympia stood at 0.23 above the normal.

Areas of Low Barometer.—During the month sixteen areas of low pressure have occurred within the limits of the Signal Service maps, only ten of which have been sufficiently definite to permit of charting. No storm has been charted entirely across the country. The marked meteorological feature of the month has been the advent of three violent cyclonic storms, a most unusual number. No. V devastated the Texas coast at the mouth of the Rio Grande river, during the 12th and 13th. In its passage over the Gulf of Mexico, the steamer *San Salvador*, long over due, was probably lost. No. X during the 18th, passed over Jamaica, where it caused the loss of several lives and did immense damage to shipping, buildings, crops and other property. No. XVI, the cyclone in which the S. S. *City of Vera Cruz* was lost, moving eastward to the north of the Bahamas on the 28th, crossed northern Florida during the 29th and 30th. This storm strewed the Florida coast with wrecks and did great damage to property and growing crops. As far as has been noted the loss of life was confined to the crew and passengers of the S. S. *City of Vera Cruz*.

No. I—was a continuation of area No. XII of the July REVIEW. Central the morning of the 1st in Minnesota, at midnight it had reached the northern part of Lake Huron, whence by a northeasterly course, it passed down the valley of the St. Lawrence during the 2nd. On the afternoon of the 1st, Cautionary Signals were ordered for Lake Michigan and the New Jersey coast, and at midnight for Lake Huron and the western half of Lake Erie. These signals were lowered during the 2nd, having been justified: maximum wind velocities, NW. 40 at Milwaukee; N. 45 at Sandusky; N. 26 at Escanaba; S. 34 at Cape May; S. 32 at Chincoteague and Delaware Breakwater; SE. 26 at Cape Henry.

No. II.—This area, apparently developing in the Gulf of Mexico, was central the morning of the 3rd in the Lower Mississippi valley; Vicksburg barometer 0.18 below the normal. Moving slowly eastward it dissipated in Florida during the 4th. In the afternoon of the 3rd, Cautionary Signals were ordered from Cape May southward to Smithville, and were lowered the following morning: maximum velocities, Cape Lookout, S. 27; Cape Hatteras, SE. 27; Kittyhawk, SW. 33; Chincoteague, S. 32.

No. III.—This area, appearing in the Northern Plateau district the morning of the 4th, moved slowly eastward to Dakota, where it was central the morning of the 6th; Bismarck barometer 0.24 below the normal. Its course thence was northeastward and beyond the Signal Service stations until the 9th, when it passed eastward through the Canadian Maritime Provinces over the Atlantic. No signals were ordered nor dangerous winds reported during the passage of this area.

No. IV.—During the night of the 10th a general fall occurred in the Plateau district and in the Pacific coast region. On the afternoon of the 10th, the lowest pressure was reported from Virginia City—0.20 below the normal, and from Ft. Keogh, Montana—0.26 below the normal; by the morning of the 11th, the depression had either filled up or moved northeastward in Manitoba.

No. V.—This storm, evidently cyclonic, apparently developed in the Caribbean sea previously to the 5th, on which date, the pressure of 29.78, with easterly wind and rain, was reported from Guadalupe. During the 5th and 6th, strong E. to S. winds, with rain, were reported from St. Thomas, and on the 7th and 8th from Navassa; these two stations were too far northward of the centre to show any decided barometric fall. On the 6th, "a most remarkable fall of the barometer,"

(no figures given) is reported by Mr. Maxwell Hall, at Kingston, Jamaica, with squalls and rain. The steamer *San Salvador* which left Truxillo, Honduras, August 7th, is now twenty-eight days overdue, and is supposed to have been lost in the cyclone. Off Cape San Antonio, August 9th, the steamer *E. B. Ward* lost rudder and had cargo injured; and at same place, ship "Tula," August — (probably 9th), encountered severe hurricane. On August 10th, brig *Adino* was wrecked on Alecranes reef. During the night of the 10th and the morning of the 11th, the barometer fell slowly at Brownsville, but remained stationary to the northward. From midnight of the 11th the barometer sank rapidly at Brownsville, reaching, at 9:33 p. m. of the 12th, 29.69 or 0.40 below the normal; wind N. 40 miles. By 11:45 p. m. the barometer had fallen to 28.315 (1.38 inches in 2 hours 12 minutes), while the wind increased to hurricane force—anemometer blown down at 10.48 p. m., registering 48 miles; from 11:45 p. m. a calm prevailed for 1 hour, when barometer commenced rising and wind shifted to south, the centre having passed over Matamoras, several miles south of Brownsville. Moving slowly up the valley of the Rio Grande, the area was central at midnight of the 13th in Mexico to the westward of Eagle Pass. Following a northeast course, the depression filled up in western Texas during the 14th. From the 12th to 14th, exceedingly heavy rains fell in connection with this storm, as shown under the heading of *Heavy Rains*. In Brownsville, Tex., a large number of buildings were blown down and great damage otherwise done. At Fort Brown about twenty buildings were blown down, barracks badly damaged, 35 horses and mules killed. In Matamoras, over three hundred houses were blown down or rendered uninhabitable, and many others seriously damaged; two persons were killed and many injured, four seriously. Two steamboats in the Rio Grande river were sunk. At Point Isabel, eight vessels wrecked, three men lost. Ten miles of railway between Brazos, Santiago and Brownsville swept away or badly damaged. Damage in Brownsville and Matamoras and vicinity estimated at one million dollars. Cautionary Signals were displayed at Galveston and Port Eads, the morning of the 12th to the morning of the 14th. On the morning of the 13th, special telegraphic despatches were sent warning vessels against venturing that day into the southwestern Gulf. Maximum wind velocities of 64 NE. at Indianola, and 29 NE. at Galveston, reported.

No. VI.—During the 14th the barometer fell steadily in southern California, and on the morning of the 15th the lowest pressure was reported from Yuma,—0.21 below the normal. Moving slowly northward the area of lowest pressure on the morning of the 16th was at Los Angeles, —0.24 below the normal. During the day the depression gradually filled up.

No. VII.—During the 15th the pressure decreased over Colorado and New Mexico, and at midnight the lowest pressure was reported from Santa Fe, —0.17 below the normal. Moving northeastward, the area was central in the Missouri valley, with rapidly decreasing pressure during the 16th, at midnight the barometer at Breckenridge was reported 0.35 below the normal. The area thence passed northeastward into British America. At midnight of the 15th Cautionary Signals were ordered for the South Carolina and Delaware coast, and the southern half of Lake Michigan, followed in the afternoon of the 16th, by Signals for Lake Superior and the rest of Lake Michigan. These Signals were lowered on the 17th, having been generally justified; maximum velocities: Milwaukee, SE. 28; Capes Hatteras and Lookout, NE. 34; Ft. Macon, E. 28; Delaware Breakwater, NE. 25.

No. VIII.—During the night of the 17th, the barometer sank rapidly over the entire Lake region. On the morning of the 18th, an area of low pressure was central in Wisconsin; Duluth barometer, 0.21 below the normal. Moving slowly eastward, it was central in the afternoon over the eastern part of Lake Superior; Escanaba barometer, 0.24 below the normal. Its course thence was northeastward beyond the limits of the Signal Service stations. No Cautionary Signals were displayed during the passage of this area. The following high winds at scattering stations were reported: Escanaba, SW. 40; Sandusky, S. 30; Port Huron, SW. 30; Alpena, SW. 28.

No. IX.—This area appears to have sprung up from the remains of low area No. VIII. At midnight of the 18th a sharp rise was reported from the Upper Lake region, while the barometer still continued falling in the Lower Missouri valley, where this area was central on the morning of the 19th; Omaha barometer 0.24 below the normal. On that afternoon an area of low pressure extended from the Lower Missouri valley, northeastward to the Gulf of St. Lawrence. Violent thunder-storms were reported from the Lake region, with the following maximum velocities: Cleveland, N. 25; Erie, NW. 28; Grand Haven, SW. 34; Sandusky, NW. 50. On the morning of the 20th the area of low pressure covered the Lower Lake region, with no well defined centre; Buffalo, Erie and Port Huron barometers 0.32 below the normal. A new depression which appeared in Manitoba during the night of the 19th, moving southeastward during the 20th, merged into this area, and the pressure remained substantially unchanged over the Lower Lake region until the 21st, when the area moved slowly northeastward to the Gulf of St. Lawrence. No Cautionary Signals were displayed during the passage of this area.

No X—is the West India cyclone which swept with such disastrous results over the island of Jamaica during the night of the 18th of August. Additional interest attaches to this storm on account of the comparative rarity of such visitations to Jamaica. The early history of the storm is at present confined to the account furnished by the log of the *S. S. Nith*, for an extract of which this office is indebted to Mr. Maxwell Hall, of Kingston.

At noon of the 15th of August, the south point of Gaudaloupe bearing north about 3 miles, the wind as observed on board the vessel was fresh from NE., gradually increasing with hard squalls. The 16th commenced with similar conditions; at 8 a. m. the wind was E., at times backing to NE. with heavy overcast sky; at noon the vessel was in $16^{\circ} 4' N. 65^{\circ} 55' W.$, with less wind but sea running high and turbulent; afterward hard gale and heavy squalls, which continued, with torrents of rain, during the early portion of the morning of the 17th; toward noon of the 17th the wind moderated and veered from NE. to SE. and S.; at noon of the 17th the vessel was in $16^{\circ} 10' N. 70^{\circ} 26' W.$, barometer reading 29.35, wind again heavy, in squalls, with thunder and lightning; toward sunset the storm abated somewhat, but at 9 p. m. it came on with renewed force. August 13th commenced with terrific squalls from E. to SE., torrents of rain and incessant thunder and lightning; toward noon the storm increased in violence and the vessel was headed to the south; at noon she was in $16^{\circ} 27' N. 74^{\circ} 57' W.$, the barometer reading 29.15; at 4 p. m. the wind veered to southward and moderated; at 8 p. m. the vessel was put on her course again (toward Jamaica) and at midnight the weather was comparatively fine. Although no barometer observations are given for the 15th and 16th, it is evident that the vessel and the storm vortex were traveling westward along converging paths, the progressive motion of the latter being greater than the speed of the vessel. On the 17th the two paths were rapidly approaching each other, and on the 18th the distance between them must have been quite small. The reports from Barbadoes, Martinique and Navassa, not yet to hand, will undoubtedly throw much light upon this portion of the storm's history. At St. Thomas a slight fall in the barometer was reported on the 15th and 16th, with cloudy weather and light rains; the prevailing easterly winds increased slightly in strength and at the afternoon reports of the above dates are described as "gusty." On the Island of St. Domingo "continuous heavy rains and high winds prevailed from the 15th to the 19th" doing great damage to crops. The S. S. *Atlas*, at Aux Cayes, on the southwest coast of Hayti, left that port on the afternoon of the 18th. The captain states that while in port "the wind set in strong from the NE. and veered around to E. when the barometer (corrected) fell to 29.1. He put out to sea in the direction of Jacmel and allowed the storm to pass." Mr. Maxwell Hall, in transmitting the above, states, "it appears that two cyclones converged on Jamaica on the 18th, the more southerly one traveling at the rate of 12½ knots and the more northerly one at 23 knots an hour," and "that he is collecting material for working out this remarkable disturbance." At Kingston, Jamaica, the barometer had been in a disturbed condition since the 6th, and Mr. Hall had advertised in the daily press that Cautionary Signals would be hoisted when a storm was to be expected. Notice of the present storm, however, was posted by Mr. Hall only six hours before its arrival, for which he gives the following reasons: "(I) for many years these cyclones have passed so far south of Jamaica that they have hardly affected us, and it became necessary to make sure on the 18th that the cyclone was not proceeding as usual; (II.) absence of wind; the slow cloud-drift seeming to give another day, but we were really sheltered by the Blue Mountain Ridge, hills 7,000 feet high, to the north of us; (III.) a high velocity of progression—15 miles per hour, I believe, being above the average." The sea at this port was disturbed on the evening of the 17th, and still further on the 18th, the waves coming from the east. The barometer at 7 a. m., (18th,) read 29.86; at 3 p. m., 29.69, when a rapid fall set in, the barometer at 9:15 p. m. reading 28.93, after which it rose to 29.40 at 11 p. m., and at 7 a. m. of the 19th had reached 29.82. Up to 8 p. m. of the 18th the wind remained almost calm, light airs, (2 miles per hour), from the NW. being the highest velocity recorded; at 8:15 p. m. it was ENE. 5 miles, increasing to 10 miles at 9:15 p. m.; at 9:30 it had increased to SE., 15 and at 9:45 to S. by E., 20. It then rapidly increased, and at 10 p. m., was S., 60; 10:15, S., 80; 10:30, S., 60; 10:45 to 11, SSW., 70; 11:15, SSW., 50; 11:30 to midnight, WSW., 20. The weather during the 17th, and morning and afternoon of the 18th, was close, warm and cloudy, the clouds moving from the NE; heavy rain set in during the evening and continued to near midnight. The following newspaper items, arranged geographically in three sections, will serve to indicate the severity and path of the storm over the Island of Jamaica. Beginning at the southeast corner and taking the section south of the mountain range we have:—(I.) along the coast—Plantain Garden river—hurricane during the night of the 18th did serious damage. Morant Bay, church, hospital and chapels completely destroyed, three vessels ashore, one life lost. Yallahs, 59 houses destroyed, three lives lost, schooner *Kate* badly handled off the southeast coast Wednesday night. Port Royal, all wharves destroyed. Port Henderson and Apostles Battery in ruins. Fort Augusta reported under water. Old Harbor Bay, church and houses destroyed. (II.) In the interior from St. Marys in the east, to Manchester in the west. Up Park Camp, near Kingston, military barracks destroyed; \$50,000 damage. Creighton, church blown down. Newcastle, barracks blown down, one man killed. Mt. James district, houses blown down. St. Thomas in the Vale, houses blown down, crops ruined, one life lost. Spanishtown, storm burst about 9 p. m. and passed over with circular sweep, buildings and trees damaged. St. Dorothy district, storm severe, two distinct earth-quake shocks, six places of worship destroyed. St. John's, 40 houses and crops destroyed. Chapelton, rained all day, at 6 p. m. began blowing from a northerly direction, and changing to NW. continued to 2 a. m. on the 19th; violent from 9 p. m. to midnight, buildings and crops destroyed. Alley P. O., Vere Co., north breeze, blowing down canes, river very high, rainfall during storm 0.85 in.; during 18th, 1.54 inch. Mandeville, 18th, slow rain; evening, increasing wind; 8 to 9 p. m., cyclone commenced; midnight, lulled, buildings damaged. In the mountains—Trinityville, Blue Mountain valley, gale experienced in all its severity; when day dawned the district was a scene of desolation, few houses standing, &c. At Cinchona plantation, elevation 5,000 feet, near the head of the Yallahs river—August 17th,

high wind, 2.44 in. rain; 18th, morning, wind N. and NW., strong gusts, heavy rain; afternoon, wind higher and sweeping with heavy rain from NE.; 3:30 p. m., barometer, unreduced, (Negretti and Zambra's), 25.11; 4:30 p. m., 25.00, temperature 65°; 7 p. m., gale; 7.15 p. m., 24.80, 64°; 8 p. m., 24.75, 60°, lull; stables and out-buildings blown down; 11 p. m., gale moderated, but shortly after blew with increased force from E. to SE; 19th, 3 a. m., lull succeeded by heavy downpours of rain till nearly day-light; rain-fall during the 19th was 20 inches. (III.) Along the north coast beginning at the east:—Manchioneal, storm raged; Port Antonio, strong wind during 17th and morning of 18th; 2 p. m., of latter date, increased to full hurricane; 3 to 4 p. m., violent rain-storm; 6 p. m., houses blown over; 7 p. m., hurricane, wind about E. by N., force increasing to 11 p. m.; 19th, 12.20 a. m., wind had changed to SW., decreasing; 1 a. m., finished by a strong blow from S. The S. S. *Tropic* in San Antonio harbor, made the following record:—18th, 6 a. m., barometer 30.00, wind E. fresh; 11 a. m., 29.90; 12 m., 29.80; 1 p. m., 29.40; 2 p. m., 29.00, heavy rains; 2.30 p. m., 28.90, wind veering to southerly; 4 p. m., 28.60, SE., heavy gale; 11 p. m., 28.40, S. heavy gale; 12 midnight, storm-centre passed to southward, barometer rising rapidly—heaviest wind from southward lasting one hour. Portland, severe storm, acres of trees and several peasant's houses blown down. Buff Bay, severe hurricane on night of 18th, destroying all houses; St. George district, 116 houses wrecked, 2 persons drowned. Annotto Bay, terrible hurricane all Wednesday night, numbers of houses in ruins. Port Maria, awful time from 7 p. m., 18th to 3 a. m. 19th, boats ashore, houses blown down, banana cultivation ruined for 12 miles around. Richmond, St. Mary's, houses blown down by hundreds, 4 lives lost. Ocho Rios, tremendous damage by cyclone, loss estimated by thousands of pounds sterling. St. Ann's Bay, 18th, wind strong from N. all day; 11 a. m., barometer 29.80; 4.45 p. m., 29.56; 9 p. m., fearful hurricane until near day-light; five coasting vessels driven ashore, wharves washed away and buildings damaged. A second report from St. Ann's says the gale increased in violence until about 12.30 a. m., 19th, when a lull took place; at 1 a. m. the wind veered to WSW. and lasted, as violently as before, until 4 a. m.; during storm rumbling sounds were heard which were attributed to two distinct shocks of earthquake. Dry Harbor, two boats wrecked and several houses blown down. Falmouth, 3 sloops ashore and buildings damaged. Montego Bay, terrible storm on 18th. These reports show the whole of the eastern portion of the Island to have been swept by the hurricane, while the extreme west and southwest portions, namely, the counties of Hanover, Westmoreland and St. Elizabeth, appear to have escaped. The storm area was probably limited on the west by a line running from Portland Point, through Mandeville to Montego Bay. P. Benito Vines, S. J., of Havana, forwards the following observations made at Manzanillo and Santa Cruz, on the south coast, and at Nuevitas, on the north coast of Cuba, which, he says "refer to the cyclone that crossed the eastern Provinces of this Island on the 19th." Manzanillo, 18th, 9 p. m., barometer 29.95, wind NE., force 2, light rain commenced; 19th, 7 a. m., 29.55, NE., 3, squally; 8:10 a. m., 29.30, E., 1, ugly; 8:15 a. m., 29.30, SE., 3 and 4, squally; 9:15 a. m., 29.40, S., 2, squally; noon, 29.70, SW., 1, cloudy. Santa Cruz, 18th, midnight, 29.92, NE., hard and variable; 19th, 8 a. m., 29.74, N., hard; at 9 a. m., NNW., fresh and 10 a. m., NW.; noon, barometer 29.71, after which it rose and at night-fall read 29.85, wind W., fresh. Nuevitas, 19th, 11 a. m., 29.40, NE., hurricane; noon, 29.50, NE., hurricane; 4:30 p. m., 29.50, S., light, the hurricane having passed northwards. Mr. Chas. Hasselbrink, Havana, reported on August 21st, as follows: "Since the 14th, we have been under the influence of light or moderate cyclonic movements; on the night of the 16th and on the 17th, sudden anti-cyclonic rise of the barometer, with fresh breeze; on the 19th, light squalls and clouds coming with moderate rapidity from the E; night of 19th, clear sky." On the 20th, the reports from the Signal Service stations in Florida, seemed to indicate the existence of a barometric depression at some distance to the eastward, and on the 21st, the barometer at the Bermudas fell to 29.85.

No. XI.—The pressure on the Pacific coast decreased on the 20th, and remained slightly below the normal with no defined centre until the 22nd, when, at midnight, a sharp fall was reported from Visalia; barometer on the morning of the 23rd 0.18 below the normal. During the 23rd the pressure was decidedly below the normal in the entire Plateau region; on the morning of the 24th the barometer was 0.29 below the mean at Virginia City, after which the depression gradually filled up.

No. XII.—developed in the Saskatchewan district north of Montana, whence it moved eastward in British America, too far north of the Signal Service stations to permit its course to be accurately charted. The lowest pressure reported was from Fort Garry, 0.35 below the normal, in the afternoon of the 21st.

No. XIII.—At midnight of the 22nd a sharp barometric fall was reported from Dakota; Deadwood barometer 0.22 below the normal. Moving eastward through Minnesota the area was central, the morning of the 24th, in Upper Michigan, whence by a northeasterly course it passed into British America. Cautionary Signals were ordered the afternoon of the 24th, for the entire Upper Lake region and the western half of Lake Erie, where brisk winds at occasional stations had been reported. These signals were lowered at noon of the 25th, having been partly justified; maximum velocities: Duluth, N., 33; Sandusky, W., 37.

No. XIV.—During the 26th the pressure fell in the Missouri valley; midnight barometer at Yankton 0.25 below the normal. Moving slowly northeastward the area was central, the morning of

the 27th, in Minnesota; St. Paul barometer 0.21 below the normal. Central that afternoon in southwestern Wisconsin, it moved, during the night, northeastward into British America. No signals were displayed during the passage of this area. The only case of high wind reported was Milwaukee, N. 32.

No. XV.—During the night of the 27th the pressure fell rapidly in the northern Plateau district; afternoon barometer at Virginia City 0.24 and at Salt Lake City 0.21 below the normal. The lowest pressure remained in Utah or Idaho until the 30th, when it was transferred to the Eastern Rocky Mountain Slope. Missing reports prevent its centre being located. The highest winds of the month were on that day reported in that district as follows: North Platte, N. 44; Cheyenne, NW. 32; Ft. Keogh, W. 40; Deadwood, S. 25. During the 31st the area moved northeastward into Manitoba.

No. XVI.—A sufficient number of reports have not been received at this date (September 13th) to enable the accurate charting and description of this storm. No Signal Service reports from August 29th to 31st south of Jacksonville are yet at hand. This storm evidently formed to the northward of San Domingo and passed eastward to the north of the Bahamas. The hurricane which passed over the Bermudas on the 29th and 30th may possibly have been an offshoot of this area, but this is hardly probable, as on August 25th, in latitude $25^{\circ} 30' N.$ the brig *M. A. Doran* reported heavy NNE. gale veering to NW., with barometer rapidly falling from 30.40 to 29.50; bearing southward she avoided the hurricane but met at midnight heavy squalls and bad sea. On the succeeding day, August 26th, schooner *S. A. Snow* was wrecked by this hurricane 128 miles SE., of the Bermudas. On the same day brig *St. Jose* was dismasted "south of Bermudas," no position given. Ship *Sunrise* on the 26th, in $26^{\circ} N.$, $69^{\circ} W.$, fell into the SW. quadrant of a violent hurricane, moving NNW. These reports indicate that the Bermuda hurricane originated south of $25^{\circ} N.$, and to the eastward of $61^{\circ} W.$, and curved southward of the Bermudas. The Florida hurricane was located on the 27th in $25^{\circ} 50' N.$, $74^{\circ} 10' W.$, where it overtook the steamship *Santiago* at noon; hurricane wind NNW., NE. sea; barometer 29.80. At midnight wind shifted to very heavy SW., and high cross seas; barometer 29.49; after which wind and sea moderated. On the 28th the steamship *New Orleans* was struck by the cyclone at 8 p. m., 40 miles ENE., of Jupiter Inlet about $27^{\circ} N.$ In both these cases winds backed from NNW. to SE., showing that the hurricane passed to the northward. On the same date the *Morgan City*, of Florida coast, experienced a hurricane from the W., backing to SE., and lasting till the 29th; barometer fell from 30.00 to 28.70. On the 29th the steamer *Vera Cruz* foundered on the Florida coast off the St. John's river, many lives lost. A number of other vessels were wrecked or disabled on the Florida coast between Jupiter Inlet and St. John's river. During the 29th and 30th the hurricane passed across Florida. At Cedar Keys the storm was one of the worst ever known. On the morning of the 30th the wind reached its maximum,—64 miles NE. registered, after which time the registering apparatus was disabled. During the 30th and 31st, 6.73 inches of rain fell. The lowest barometer reading reported was 29.40 at 2 p. m., of the 30th. One vessel, the bark *Proteus*, at Cedar Keys, was dismasted and otherwise damaged. Several buildings were blown down and others damaged; on the railway between Cedar Keys and Fernandina several serious washouts occurred. During the 31st the storm moved slowly northeastward through Florida into Alabama with rapidly increasing pressure and decreasing violence. At Pensacola the highest wind SW. 32 and lowest barometer 29.33 were reported on the 31st. At midnight of the 28th Cautionary Signals were ordered for all Florida stations except Pensacola, and on the following day for Pensacola, Mobile, Port Eads, and as far north as Sandy Hook. Owing to interruption of telegraphic communication, signal orders failed to reach Cedar Keys and Key West. On the 29th special messages announcing the cyclone were sent to all Atlantic and Eastern Gulf seaports. The signals from Savannah to Wilmington and Norfolk were lowered on the 30th, and at other stations on the 31st. These signals were justified, except on the North Carolina coast; maximum wind velocities were reported as follows: Cedar Keys, NE., 64; Barnegat, NE., 42; Pensacola, SW., 36; Cape May, NE., 36; Delaware Breakwater and Jacksonville, NE., 32; Key West, SW. 32.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present Review. They are for the months of *July*, 1880 and *December*, 1878.

On chart No. IV will be found the probable course of the principal low barometer areas over the North Atlantic Ocean during the month of *July*, 1880. Three of them, II, IV and V, are extended tracks of low areas, II, V and VI of the *July REVIEW*, chart I, and appear to have curved northward before reaching the 50th meridian. Four of them, I, III, VI and VII appear to have originated to the east of the 20th meridian on the 1st, 6th, 14th and 17th respectively. Reports at present to hand indicate continued high pressures and light winds over the central portion of the ocean, (between the parallels of 30 and 50) from the beginning of the month to the 22nd. On the 23rd a decided fall set in from the northward, over the eastern portion, which during the 24th gradually extended westward to $45^{\circ} W.$ forming an extensive area of low barometer, which on this day probably included the whole of the Atlantic north of the Azores. During the 25th and 26th it appears to have moved southeastwards towards the British Channel and its path is marked upon the chart as No. VIII. On the 27th, another area, No. IX seems to have developed to the west of Ireland and subsequently to have moved eastward toward the North Sea. On the 30th and 31st quite high pressures were again recorded over mid-

ocean. The following summary of extracts from the logs of ocean steamers on 46 voyages between the United States and Europe, (as given in the *N. Y. Maritime Register*,) during the month will serve to illustrate the unusually fine weather prevailing. Out of an aggregate of 345 daily reports, "rain squalls" were reported in 6 cases, "squally weather" in 7 cases and "moderate gale," the highest wind recorded, in only 3 cases. Of these 16 cases, 11 occurred to the east or west, respectively, of the meridians of 17° and 47° W and attended the low areas shown on chart. The other 5 cases, which included two of the "moderate gales," occurred after the 22nd and attended areas Nos. VIII and IX. Out of an aggregate of about 176 daily simultaneous observations taken on 22 voyages between the two continents and reported directly to this Office, only 6 cases were reported of winds over force 6 on Beaufort scale. Three of these were moderate to fresh SW'ly gales experienced in connection with area No. IV on the 11th and 12th, and reported by steamers *Indiana* and *Braunschweig*, and the other three, northwesterly moderate to strong gales in connection with areas Nos. VIII and IX, reported by steamers *Indiana* and *Scythia* on the 28th, 30th and 31st. The following storms of limited extent were reported along the American coast: From the 7th to the 11th, bark *Veigtut* experienced a southerly gale, with heavy squalls, along the southwest coast of Greenland. On the midnight of the 9th, ship *Jumna*, at Sydney, C. B., experienced a very heavy storm of wind and rain, and heavy thunder and lightning, lasting 2 hours, and on the 17th, schooner *Addie Fuller*, in $33^{\circ} 40' N. 78^{\circ} 40' W.$, had a severe thunder-storm which lasted about two hours—rainfall in about 1 hour and 45 minutes, 1.97 inch; the wind blew in fearful gusts from NW., and the disturbance seemed to move from WNW. toward SSE. On July 28th, steamer *Sceptre*, in $39^{\circ} 47' N. 68^{\circ} 18' W.$, passed a well-defined waterspout within half a mile of the vessel, traveling rapidly to ENE.; weather at the time overcast and gloomy, with heavy rolling swell from the SSE.

Upon chart No. V are shown for the month of December 1878, the mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 a. m. Washington mean time, (0:43 p. m. Greenwich mean time) for the northern hemisphere, and at certain detached stations in the southern hemisphere. High pressures (30.20 in. or 767.1 mm. and above) covered in Asia, the greater part of Siberia and in America, a wide belt of country, extending from the Gulf of Mexico to the Oregon coast. Low pressures (29.80 or 756.9 and below) covered all of northern Europe, and in America, an area about 10 degrees wide, extended from the Canadian Maritime Provinces southeastward over the Atlantic ocean to about 30° W. The lowest isobar, 29.60 or 751.8 included Denmark, the North sea, Southern Sweden and the extreme eastern coast of Norway. The lowest pressure, 29.39 or 746.5, prevailed at St. Paul's Island, Behring's sea, and the highest 30.59 or 777.0 at Yeniseisk. The highest barometric reading noticed was 31.26 at Yeniseisk, Siberia, December 23rd, 1878, and the lowest 28.03 at St. Paul's Island on December 31, 1878, showing a range of 3.25 inches for the northern hemisphere. As compared with the chart of mean pressure for December 1877, the barometric conditions present little if anything in common. In 1877, the high pressure in Siberia was much further eastward, the area of comparative low pressure in the interior of the United States had (in 1878) given place to an area of high pressure, and the area of lowest pressure then over Iceland had withdrawn southward and given place to a mean at Stykkisholm of 30.10 as against 29.25. Over the Azores the high mean pressures were replaced by a pressure averaging 0.50 lower. A remarkable range of mean pressures in the northern hemisphere is shown for December, 1878, being 1.20 inch—from 29.39 at St. Paul's Island to 30.59 at Yeniseisk. As compared with the mean pressure for November, 1878, the following are the greatest changes: St. Michael's, +0.47; Yeniseisk, +0.23; St. Paul's Island, +0.22; Ekaterinburg, +0.21; Barnaul, +0.20; North Atlantic ocean between 40° and 50° N., 30° and 40° W. -0.37; Kertch, -0.31; Angra, -0.24; Ponta Delgada, -0.23; Moscow, -0.22; Sandwich and Constantinople, -0.20; Valentia and Tokio, -0.19. The regions of highest pressure and lowest temperature are nearly coincident over Siberia. A remarkable feature of the temperature in December is the unusually high temperature in Greenland, $31^{\circ}.0$ at Godthaab, and northeastern coast of America, where nearly the same temperature prevailed as in the preceding month; at Godthaab on December 6th, the unusually high temperature of 56° is noticed. In general southwesterly winds prevailed in Europe and Algeria; northwesterly winds in America (except on the Pacific coast, where they were northeasterly), and the Atlantic ocean W. of longitude 40° W. Over the rest of the Atlantic, the winds were southwesterly S. of latitude 40° , and northeasterly north of that parallel and in the British Isles. The predominating winds in Asia, where calms did not prevail, were, northwesterly in India, southeasterly in Siberia, and northeasterly along the entire eastern coast.

On chart No. VI are traced the paths of twenty-six of the principal storm-areas of the Northern Hemisphere for the month of December, 1878. The recurving of the paths of storms noticed in the REVIEW of last month, as occurring in the storms of November, 1878, is strongly marked in those of December in areas II, VIII and XXI. The southerly positions of the paths over the eastern portion of the United States, the Atlantic ocean and Europe, the rapid progressive motion of storms along the Atlantic coast of the American continent, and their retarded progress over the central and eastern portions of the Atlantic ocean are marked features.

TEMPERATURE OF THE AIR.

The mean temperatures for August, 1880, are shown by isotherms on chart No. II. The table of average temperatures on that chart shows a deficiency of temperature for the entire country, except

Tennessee, the Ohio, Upper Mississippi and Lower Missouri valleys, from which sections slight excesses, not exceeding 1°, were reported. Deficiencies exceeding 1° are as follows: Pacific coast, about 2°; Plateau districts, from 2° to 3°; St. Lawrence valley, 2°; Upper Missouri valley, 4°; and Rio Grande valley, 6°.

The following list shows the maximum and minimum temperatures in each State and Territory:

Maximum and Minimum Temperatures.—Upon charting the maximum temperatures for the month, it is found that such temperatures (except along the immediate Pacific, Middle Atlantic and southern New England coasts and the northern half of the Lake region,) range from 90° to 99°. Maximum temperatures exceeding 100° are reported from all of southern Arizona and from the following scattered stations: Corsicana and Ft. Keogh, 100°; Denison, Rio Grande City, Bismarck and St. Louis, 101°; Umatilla and Edinburg, 102°; Red Bluff and Visalia, 103°; the highest temperatures were Yuma and Burkes, 111°, Florence, 112°; and the lowest Wood's Holl and Pembina, 80° and San Francisco, 73°. The isotherm of 60° of minimum temperatures leaves to the southward Virginia, Tennessee, the South Atlantic and Gulf States, except the northern half of Texas. East of the Mississippi river the isotherm of 50° passes through Massachusetts and the southern stations of the Lake region. Minimum temperatures of 70° or above were reported from every station on the immediate Gulf coast, except Galveston 67°. The highest minimum temperatures were: Key West and Edinburg, 76°, New Orleans, 71°; and the lowest, except at elevated stations, Campo, 31°, Marquette, 39°, Burlington, Vt., and Pembina, 40°.

Maximum Temperatures.—*Alabama*: 96° at Mobile and 97° at Montgomery. *Arizona*: 92° at Prescott, 111° at Burkes and Yuma and 112° at Florence. *Arkansas*: 92° at Little Rock and 93° at *Mount Ida. *California*: 73° at San Francisco, 102° at *Princeton and Campo. *Colorado*: 62° at *Summit and 93° at Denver. *Connecticut*: 88° at New Haven, *Southington and *Mystic. *Dakota*: 92° at Fort Buford and 101° at Bismarck. *District of Columbia*: 95° at Washington. *Delaware*: 90° at *Dover. *Florida*: 91° at Punta Rassa, 96° at Jacksonville and 101° at *Gulf Hammock. *Georgia*: 96° at Augusta and 99° at *Forsyth. *Iowa*: 100° at Keokuk, 102° at *Muscatine and *Glenwood and 104° at *Boonesboro. *Idaho*: 97° at Boise City. *Illinois*: 97° at Springfield, 100° at *Peoria and *Mount Sterling. *Indiana*: 94° at Indianapolis and 100° at Logansport. *Indian Territory*: 99° at Fort Gibson. *Kansas*: 98° at Leavenworth, 103° at *Topeka and 104° at *Fort Leavenworth. *Kentucky*: 94° at Louisville. *Louisiana*: 94° at Shreveport and 103° at *Point Pleasant. *Maine*: 92° at Portland. *Maryland*: 91° at Baltimore and 93° at *Emmitsburg. *Massachusetts*: 96° at Boston. *Michigan*: 89° at Port Huron and 93° at *Lansing. *Minnesota*: 98° at St. Paul. *Mississippi*: 98° at Vicksburg. *Missouri*: 101° at St. Louis and 103° at *Booneville. *Montana*: 97° at Fort Benton. *Nebraska*: 97° at North Platte and 104° at *Mount Howard. *Nevada*: 95° at Winnemucca and 98° at *Carson City. *New Hampshire*: 66° on Mount Washington and 98° at *Auburn. *New Jersey*: 90° at Sandy Hook and 97° at *Dodge Mine. *New Mexico*: 100° at La Mesilla. *New York*: 93° at Oswego, *Waterburgh and *Plattsburg Barracks. *North Carolina*: 94° at Smithville, 95° at *Weldon and *Statesville. *Ohio*: 92° at Cincinnati and 95° at *College Hill. *Oregon*: 102° at Umatilla. *Pennsylvania*: 98° at Pittsburgh. *Rhode Island*: 84° at Newport and 95° at *Fort Adams. *South Carolina*: 93° at Charleston. *Tennessee*: 95° at Memphis and Nashville. *Texas*: 102° at Edinburg, 101° at Denison, 100° at Corsicana, *Clarks ville and *Melissa. *Utah*: 94° at Salt Lake City. *Vermont*: 88° at Burlington and 100° at *Charlotte. *Virginia*: 95° at Norfolk. *Washington Territory*: 83° at Olympia. *West Virginia*: 88° at *Helvetia. *Wisconsin*: 92 at Madison and 97° at *Beloit. *Wyoming*: 94.5 at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—*Alabama*: 70° at Mobile, Montgomery and Pensacola. *Arizona*: 40° at Prescott and 51° at Camp Verde. *Arkansas*: 60° at Little Rock and 45° at *Mount Ida. *California*: 31° at Campo and 49° at Sacramento. *Colorado*: 50° at Denver, 41° at *Hermosa, 29° at *Summit and 22° on Pikes Peak. *Connecticut*: 46° at New Haven. *Dakota*: 41° at Fort Buford and Deadwood. *Delaware*: 62° at Delaware Breakwater and *Dover. *District of Columbia*: 59° at Washington. *Florida*: 70° at Cedar Keys, Jacksonville, Punta Rassa, Pensacola and *Fort Barrancas. *Georgia*: 64° at Atlanta and 63° at *McPherson Barracks. *Iowa*: 41° at Davenport. *Idaho*: 42° at Boise City. *Illinois*: 53° at Chicago and 45° at *Riley. *Indiana*: 51° at Indianapolis, 37° at *New Corydon and 46° at *Spiceland. *Indian Territory*: 52° at Fort Gibson. *Kansas*: 50° at Dodge City and 46° at *Manhattan. *Kentucky*: 56° at Louisville. *Louisiana*: 58° at Shreveport. *Maine*: 45° at Eastport and 38° at *Orono. *Maryland*: 61° at Baltimore, 55° at *Woodstock and *Emmitsburg. *Massachusetts*: 45° at Springfield and 36° at *Westborough. *Michigan*: 39° at Marquette. *Minnesota*: 41° at Breckenridge. *Mississippi*: 65° at Vicksburg and near *Fayette. *Missouri*: 55° at St. Louis and 50° at *Neosho. *Montana*: 31° at Virginia City. *Nebraska*: 51° at Omaha and 49° at *Austin. *Nevada*: 32° at Winnemucca and 31° at *Carson City. *New Hampshire*: 27° on Mount Washington and 32° at *Auburn. *New Jersey*: 55° at Barnegat, 46° at *Atco and *Deckertown. *New Mexico*: 45° at Silver City and Santa Fé. *New York*: 44° at Buffalo and 34° at *Schroon Lake. *North Carolina*: 59° at Charlotte, 46° at *Roan Mountain and 58° at *Ellsworth. *Ohio*: 48° at Cleveland and *Westerville. *Oregon*: 43° at Roseburg. *Pennsylvania*: 51° at Pittsburgh and 35° at *Dyberry. *Rhode Island*: 53° at Newport and 52° at *Fort Adams. *South Carolina*: 69° at Charleston. *Tennessee*: 59° at Memphis. *Texas*: 48° at Fort Elliott, 54° at Stockton

and 70° at Rio Grande City. *Utah*: 44° at Salt Lake City and 30° at *Coalville. *Vermont*: 40° at Burlington and 36° at *Woodstock. *Virginia*: 58° at Fort Whipple. *Washington Territory*: 41° at Olympia. *West Virginia*: 46° at *Helvetia. *Wisconsin*: 51° at Milwaukee and 46° at *Neillsville. *Wyoming*: 40° at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperature at Signal Service Stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England, from 19° at Wood's Holl to 32° at Burlington; Middle Atlantic States, from 16° at Chincoteague to 27° at Albany; South Atlantic States, from 18° at Savannah to 24° at Wilmington and Jacksonville; Eastern Gulf States, from 20° at Pensacola to 25° at Montgomery; Western Gulf States, from 14° at Galveston to 28° at Vicksburg; Ohio valley and Tennessee, from 20° at Cairo to 37° at Pittsburgh; Lower Lake region, from 24° at Sandusky to 33° at Oswego; Upper Lake region, from 24° at Chicago to 34° at Marquette; Upper Mississippi valley, from 24° at Davenport to 31° at Des Moines, Dubuque and St. Paul; Missouri valley, from 26° at Omaha to 41° at Bismarck; Texas, from 24° at Laredo to 35° at Fort Elliott and 41° at El Paso; Red River of the North valley, from 32° at Pembina to 39° at Breckenridge; Northern Plateau District, from 39° at Lewiston to 46° at Ft. Shaw; Middle Plateau District, from 31° at Salt Lake City to 47° at Winnemucca; Southern Plateau District, from 32° at Santa Fe to 40° at Wickenburg; Rocky Mountain Stations, 20° at Pikes Peak, 37° at Denver, 39° at Virginia City and 41° at Cheyenne; California, from 18° at San Francisco to 42° at Visalia; Northern Pacific coast region, from 31° at Olympia to 43° at Umatilla.

Frost.—*California*: Lompoc, 18th; Campo, 30th and 31st, injuring vegetables. *Colorado*: Hermosa, 30th and 31st; Summit, frequent; Pikes Peak, 2nd, 7th, and frequent after 16th. *Connecticut*: New London, 16th, light in low lands near. *Idaho*: Boise City, 25th and 26th, in low places. *Maine*: Bangor, 25th and 26th; Portland, 27th, in suburbs of city. *Massachusetts*: Rowe, 16th; Springfield, 16th and 29th; Westborough, 16th and 27th; Boston, 16th, light in suburbs. *Michigan*: Thornville, 3rd, on low grounds. *New Hampshire*: Auburn and Contoocookville, 16th, on low grounds; Grafton, 12th and 26th; 16th, damaging corn in low places, "frost very general throughout State;" Mount Washington, 5th, 6th, 15th, frost feathers 3 to 6 inches long in exposed places; 10th to 23rd. *New Jersey*: Freehold, 16th, 5 miles SE. of station; Lindon, 18th. *New York*: Ardenia, North Volney and near Penn Yan, 16th; Palermo, 16th, light; Cooperstown, Port Jervis and Nile, 16th and 17th, injuring corn, buckwheat and potatoes at latter place; Buffalo, 16th, on low grounds; Albany, 16th, on mountains near, damaging vegetables. *Nevada*: Carson City, 11th, 26th, 30th and 31st; Winnemucca, 31st. *Pennsylvania*: Blooming Grove, 16th, damaging buckwheat; Wellsboro, 16th; Dyberry, 16th and 17th, killing corn in places. *Utah*: Coalville, killing vegetables 28th. *Vermont*: Woodstock and Stafford, 16th and 26th; Lunenburg, 26th.

Ice.—*Colorado*: Summit, 3rd. *Montana*: Virginia City, 30th. *Nevada*: Winnemucca, 31st.

PRECIPITATION.

The general distribution of rain-fall, for August, 1880, is shown on chart No. III, as accurately as possible, from about 500 reports. The table on this chart shows the average precipitation for August, as compared with that of the present month. Departures exceeding one inch from the normal precipitation are as follows: Missouri valley about 1.20 excess; Lower Lake region 1.70 excess; Florida Peninsular 4.03 excess; the Gulf States about 1.25 deficiency; St. Lawrence valley about 1.25 deficiency. In Oregon and the extreme southern part of California slight deficiencies are reported, while in northern and central California no rain has fallen. The great excess in the Florida peninsula resulted from the cyclone of August 29th. As shown below a most unusual number of heavy rains occurred during the month.

Special Heavy Rains.—1st, Corning, Mo., 1.70 inches in 1 hour, 50 minutes; Jacksonville, 3.30 in. in 8 hrs.; Pierce City, Mo., 2.50 in. 2nd and 3rd, Laredo, Tex., 3.18 in. in less than 6 hrs.; Cincinnati, 2.95 in. in 24 hrs; Wellsboro, Pa., 3.92 in. 3rd, Highland, N. C., 2 in.; New Orleans, 1.17 in. in 50 min.; Fort Barrancas, Fla., 4.08 in. in 18 hrs. 3rd to 5th, Charlotte, N. C., 6.57 in. in 48 hrs. 3rd and 4th, Ellsworth, N. C., 13.00 in., of which 9.00 in. fell in 3½ hrs; Cape May, 2.95 in. in 24 hrs.; Brookhaven, N. Y., 4.16. 4th, New London, 1.32 in. in 8 hrs.; Mystic, Conn., 2.10 in.; Fort Adams, R. I., 3.10 in.; Fortress Monroe, Va., 2.06 in. 4th to 6th, Cape Henry, 5.16 in. in 48 hrs.; Norfolk, 7.20 in., of which 2.15 in. fell in 8 hrs.; Chincoteague, 5.84 in., of which 2.05 in. fell in 8 hrs. 4th to 7th, Weldon, N. C., 6.68 in. 4th and 5th, Fall River, Mass., 2.95 in. in 17 hrs.; Somerset, 2.57 in., of which 2.00 in., fell in 1 hr. 10 min.; Fall River, 2.25 in. in 28 hrs.; Vine-land, N. J., 2.85 in. in 21 hrs.; Dover Mines, Va., 2.15 in. in 25 hrs. 30 min.; Johnstown, Va., 2.08 in., in 44 hrs.; New Bedford, Mass., 3.20 in. in 25 hrs. 30 min.; Newport, R. I., 3.57 in. in 24 hrs.; Barnegat, 2.41 in. in 24 hrs. 5th, Highland, N. C., 2.85 in.; Kittyhawk, 2.40 in. 5th and 6th, Cedar Keys, Fla., 5.38 in., of which 4.06 in. fell in 16 hrs. 6th, Fortress Monroe, Va., 3.75 in. Thomasville, Ga., 2.04 in. in 5 hrs. 40 min. 8th, Fayette, Miss., 2.60 in. in 6 hrs. 30 min.; Rio Grande City, Texas, 1.81 in. in 8 hrs. 9th, Point Pleasant, La., 2.00 in.; Fort Scott, Kan., 2.62 in. in 10 hrs. 10th, White Plains, N. Y., 1.80 in. in 1 hr. 30 min.; Fort Barrancas, Fla., 2.64 in. 11th, Wellsboro, Pa., 1.60 in. in 30 min.; Wilmington, 2.02 in. in 8 hrs., South Orange, N. J., 2.10 in. in

less than 10 hrs.; Edinburg, Texas, 2.40 in. in 2 hrs. 30 min.; Hulmeville, Pa., 1.05 in. in 25 min.; 11th and 12th, Rio Grande City, Texas, 2.90 in. in 24 hrs. 12th, Smithville, N. C., 2.40 in. in 8 hrs.; Brownsville, Tex., 11.71 in. in 24 hrs.; Rio Grande City, 2.90 in. in 24 hrs. 12th and 13th, Indianola, 7.21 in., of which 4.10 in. fell in 16 hrs. 13th, San Antonio, Tex., 7.22 in., of which 6.74 in. fell in 16 hrs.; Uvalde, Tex., 3.12 in.; Brackettsville, 3.55 in.; Eagle Pass, Tex., 4.57 in.; Laredo, Tex., 2.49 in. 13th and 14th, Fredericksburg, Tex., 4.55 in.; Castroville, Tex., 5.80 in. in 24 hrs.; Austin, Tex., 2.83 in.; Mason, Tex., 2.91 in. in 24 hrs.; Uvalde, Tex., 4.96 in., of which 4.21 in. fell in 24 hrs. 14th, Fort Concho, Tex., 1.60 in.; Fort Stockton, Tex., 2.72.; Fort McKavett, Tex., 2.41 in.; Mason, 2.35 in.; Stockton, Tex., 2.72 in. 15th, Highland, N. C., 1.25 in. in 1 hr.; Little Rock, 3.30 in. in 2 hrs. 20 min.; Omaha, 0.80 in. in 20 min. 15th and 16th, Ellsworth, N. C., 4.33 in. 16th, Memphis, 1.86 in. in 47 min.; Charlotte, N. C., 2.00 in. in 4 hrs.; Boonsboro, Iowa, 2.25 in. 16th and 17th, Pembina, 2.54 in. in 24 hrs. 17th, Vicksburg, Miss., 2.22 in. in 2 hrs. 40 min.; Cleveland, 0.87 in. in 30 min. 19th, Buffalo, N. Y., 1.60 in. in 1 hr. 19th and 20th, Bellefontaine, O., 5.28 in. in 24 hrs. 25 min.; Columbus, O., 3.79 in. in 12 hrs. 20th, New Corydon, Ind., 2.25 in. in 11 hrs. 45 min.; Louisville, 0.50 in. in 18 min.; Dodge City, 2.07 in. in 2 hrs. 50 min. 21st, Flushing, N. Y., 1.00 in. in 1 hr.; New Haven, 1.72 in. in 1 hr. 40 min.; Willett's Point, N. Y., 1.24 in. in 45 min.; El Paso, Tex., 1.00 in. in 2 hrs. 23rd, Des Moines, 2.07 in. in 16 hrs.; Stockton, Tex., 2.55 in.; Kittyhawk, 3.31 in. in 17 hrs. 35 min.; Boonsboro, Iowa, 2.00 in.; Corning, Mo., 2.95 in.; Stockton, Texas, 2.45 in.; Portsmouth, N. C., 2.10 in. in 8 hrs. 23rd and 24th, Howard, Neb., 3.45 in.; Morrison, Ill., 4.52 in., of which 3.00 in. fell in 8 hrs. 15 min.; Phelps City, Mo., 5.65 in. in 17 hrs. 24th, Manhattan, Kan., 1.32 in. in 30 min.; Topeka, Kan., 3.44 in. in 7 hrs.; Jacksonburg, O., and Coldwater, Mich., 1.00 in. in 1 hr. 24th and 25th, Kittyhawk, 2.52 in. in less than 16 hrs.; Fort Keogh, Mont., 1.13 in. in 10 hrs. 25th, New York, 1.45 in. in 2 hrs. 20 min.; Manhattan, Kan., 1.35 in. in 1 hr.; Philadelphia, 2.08 in. in 2 hrs.; Grand Haven, 3.10 in. in 16 hrs.; Fort McHenry, Baltimore, 2.24 in.; Somerville, N. J., 2.13 in. in 1 hr.; Chattanooga, 1.31 in. in 1 hr. 30 min. 25th and 26th, Muscatine, Ia., 2.04 in. in 12 hrs.; Omaha, 1.54 in. in 3 hrs.; Paterson, N. J., 2.43 in. in 2 hrs. 26th, Davenport, 1.40 in. in 4 hrs.; Madison, Wis., 1.42 in. in 1 hr. 45 min.; De Soto, Neb., 2.18 in. in 2 hrs.; Cheyenne, 0.45 in. in 20 min.; Cincinnati, 4.50 in. 27th, Peoria, Ill., 2.10. 27th and 28th, Genoa, Neb., 2.40 in. in 8 hrs. 28th, Little Mountain, O., 1.95 in. in 9 hrs.; Lunenburg, Vt., 1.70 in. in 2 hrs.; Mt. Washington, 1.12 in. in 3 hrs.; Fort Sill, I. T., 2.40 in. in 9 hrs.; Lawrence, Kan., 2.45 in. in 11 hrs.; Cheyenne, 1.30 in. in 35 min.; Helvetia, W. Va., 0.58 in. in 20 min.; Carrollton, Mo., 3.25 in. in 7 hrs. 29th, New Haven, 3.34 in., of which 2.18 in. fell in 3 hrs., and 1.16 in. in less than 1 hr.; Bismarck, Dak., 1.32 in. in less than 8 hrs.; Coldwater, Mich., 0.50 in. in 10 min.; Hat Creek, Wyo., 2.15 in. in 4 hrs.; Carrollton, Mo., 2.00 in. in 6 hrs. 29th and 30th, Daytona, Fla., 7.31 in.; Somerset, Mass., 2.81 in. in 26 hrs. 30th, Dover Mines, Va., 2.70 in. in 4 hrs. 45 min.; New Harmony, Ind., 1.18 in. in 75 min.; Augusta, Ga., 0.51 in. in 13 min. 30th and 31st, Thomasville, Ga., 4.05 in.; Yates Centre, Kan., 0.62 in. in 20 min. 31st, Fort Scott, Kan., 3.10 in. in 7 hrs.; Cape Henry, 2.01 in. in 4½ hrs. 30th and 31st, Cedar Keys, Fla., 6.73 in.; Richmond, Va., 3.27 in.

Largest Monthly Rain-falls.—Ellsworth, N. C., 28.33 inches; Cedar Keys, Fla., 19.45; Cape Hatteras, 15.30; Brownsville, 16.58; Thomasville, Ga., 12.73; Corning, Mo., 12.61; Kansas City, Mo., 12.26, (Missouri Weather Review); Ft. Scott, Kan., 11.61; Kittyhawk, N. C., 11.18; Charlotte, N. C., 10.57; Daytona, Fla., 10.51; Phelps City, Mo., 10.50; Ft. Barrancas, Fla., 10.16; Kansas City (Signal Service), 10.13; Chincoteague, Va., 10.00; Weldon, N. C., 9.98; Norfolk, 9.90.

Smallest Monthly Rain-falls.—California, north of Los Angeles, and in Nevada, (except Humboldt and a few stations south and west), no rain fell; Clarksville, Texas, none; Yuma and Los Angeles, trace; Winnemucca and Boise City, 0.02; Texas Hill, Ariz., 0.03; St. George, Utah, 0.05; San Geronio, Cal., 0.09; Corinne, Utah, 0.10; Austin, Nev., 0.11; Decatur, Texas, 0.14; Humboldt, Nev., and White Hill, Ariz., 0.25; Kingston, Can., 0.29 (?); Carlin, Nev., 0.34; Griffin, Tex., 0.40; Pioche, Nev., 0.47; Fillmore, Utah, 0.50.

Rainy Days.—The number of days on which rain or snow has fallen, varies as follows: New England, 9 to 17; Middle Atlantic States, 9 to 16; South Atlantic States, 10 to 19; Eastern Gulf States, 12 to 15; Western Gulf States, 5 to 18; Ohio valley and Tennessee, 7 to 20; Lower Lake region, 11 to 17; Upper Lake region, 12 to 16; Upper Mississippi valley, 7 to 14; Missouri valley, 9 to 13; Red River of the North valley, 9 to 15; Texas, 1 to 16; Rocky Mountains, 7 to 22; Middle Plateau, 1 to 4; California, 0 to 2; Oregon, 4 to 5.

Cloudy Days.—The number varies in New England from 2 to 11; Middle Atlantic States, 7 to 19; South Atlantic States, 4 to 18; Eastern Gulf States, 4 to 11; Western Gulf States, 2 to 9; Ohio valley and Tennessee, 4 to 11; Lower Lake region, 6 to 13; Upper Lake region, 6 to 13; Upper Mississippi valley, 1 to 10; Missouri valley, 7 to 9; Red River of the North valley, 8 to 9; Texas 2 to 10; Rocky Mountains, 2 to 8; Middle Plateau, 0 to 4; California, 0 to 5; Oregon, 1 to 9.

Hail.—*Arizona:* Camp Verde, 6th, three-fourths of an inch in circumference, damaging vegetables. *Colorado:* Summit, 3rd, 8th, 10th, 12th, 15th; Pike's Peak, 1st to 3rd, 7th, 8th, 14th and 25th to 28th. *Indiana:* New Corydon, 17th; Logansport, 2nd. *Iowa:* Guttenburg, 16th. *Maine:* Bangor, 10th. *Michigan:* Coldwater, 17th; Lansing, 18th. *Minnesota:* Duluth, 12th. *Nebraska:*

Desoto, 27th and 31st. *New Hampshire*: Mt. Washington, 12th. *New Jersey*: South Orange, 11th; Sommerville, 25th, one-third of an inch in diameter. *North Carolina*: Highlands, 17th. *Ohio*: Bethel, Jacksonburg and Norwalk, 11th. *Pennsylvania*: Hulmville, 25th. *Wyoming*: Cheyenne, 26th.

Snow.—*Colorado*: Summit, 1st to 3rd, one inch. *Nevada*: Winnemucca, 29th, on neighboring mountains. *Utah*: Salt Lake City, in the mountains near, on the 30th. *Wash. Ter.*: Pomeroy, 29th, on hill near town.

Floods.—Ellsworth, N. C., exceedingly heavy rains from 1st to 6th, caused washouts on mountain division of N. C. R. R. North Platte, 26th, very heavy rains caused washouts on the U. P. R. R., delaying trains for two days. 14th, extremely heavy rains rendered all streams between San Antonio, Tex., and the Rio Grande river impassable; at Fort McKavett water rose 10 feet in 10 minutes at 4 p. m. of the 14th. On the 17th, Pecos river, Texas, impassable; bridge at Horsehead crossing swept away. At Castroville, Texas, on the 8th, river rose and became impassable in 15 minutes. Pittsburgh, 19th, violent thunder-storm; rain flooded part of Alleghany City. Colorado Springs, Colorado, 25th, heavy rain; washouts reported on D. & R. G. R. R. Rochester, 19th, very heavy rain, bursting sewers and flooding many streets. Richmond, Va., August 30th, violent thunder-storm with heavy rain, flooding the entire lower part of city, doing much damage. 21st, heavy rains of "past few days" in southern Colorado caused many washouts on different railways. Track of South Park Railway badly damaged between Thompson and Pine Grove. Bad washout on D. & R. G. R. R., on the 20th near the Divide. On the 20th Kansas Pacific trains delayed by bad washouts. Pomeroy, Wash. Ter., 29th, 2:45 p. m., a small cloud burst near town, flooding some houses.

Droughts.—Waveland, Ind., to August 23rd, very severe. Creswell, Kan., severe to 18th. Auburn, N. H., 31st, severe, "vegetation suffering badly, streams drying up;" Winnemucca, Nev. 17th, the "Sink" of the Humboldt completely dry, said to be the first time within the memory of man. Des Moines, 15th, "crops suffering." Wellington, Kan., 27th. Carrollton, Ill., and Independence, Mo., to August 20th, corn and other crops severely damaged. The *Missouri Weather Review* states that the entire State suffered from drought till the 20th.

Rainfall during July, received too late to be used in July Review.—*Arizona*, Camp Thomas, 0.87 inch; Ft. Lowell, 1.88; Ft. Verde, 1.59. *California*, Angel Island, Presidio, S. F., and Ft. Gaston, none; Summit, 0.80; Ft. Bidwell, 0.72; Salinas, 0.05. *Colorado*, Ft. Lyon, 3.09. *Dakota*, Ft. Stevenson, 0.80; Ft. Sisseton, 5.08; Ft. Sully, 1.93; Ft. Totten, 2.94. *Idaho*, Lewiston, 1.86; Ft. Lapwai, 1.78. *Kansas*, Dodge City, 4.00. *Montana*, Ft. Benton, 1.50; Ft. Shaw, 0.80; Ft. Ellis, 1.16; Ft. Keogh, 1.03; Ft. Logan, 0.93; Ft. Assiniboine, 1.72; Ft. Shaw, 1.51. *Nevada*, Toano, 0.06; Blue Creek, 1.09. *Oregon*, Ft. Stevens, 2.07; Ft. Klamath, 0.20. *Texas*, Ft. Ringgold, 0.73; Ft. Davis, 10.62. *Utah*, Corinne, 0.67. *Washington Ty.*, Dayton, 1.68; Ft. Canby, 1.48; Ft. Townsend, 1.42; Olympia, 0.52.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, from 63 to 83; Middle Atlantic States, 63 to 89; South Atlantic States, 71 to 82; Eastern Gulf States, 69 to 78; Western Gulf States, 61 to 79; Ohio valley and Tennessee, 63 to 78; Lower Lake region, 65 to 77; Upper Lake region, 71 to 78; Upper Mississippi valley, 60 to 70; Missouri valley, 60 to 65; Red River of the North valley, 73 to 76; Texas, 60 to 79; Middle Plateau, 16 to 25; California, 32 to 82; Oregon, 44 to 69. *High stations* report the following averages not corrected for altitude: Pike's Peak, 73.6; Mt. Washington, 80.3; Virginia City, 36.9; Denver, 47.2; Santa Fe, 49.2.

WINDS.

The prevailing directions of the wind during August 1880, are shown by arrows, flying with the wind, on chart No. II. From the Mississippi valley westward to the Pacific ocean the predominating winds have been *southerly*, except in the northern half of the Pacific coast region, where they were *northerly*. In New England, the Lower Lake region, the Middle Atlantic States and the Ohio valley, they have been *southwesterly*, except at a few scattered stations. In the South Atlantic States and Tennessee, they were variable, with the *easterly* points predominating. At most stations in the Upper Lake region the prevailing winds were *northerly*. On Mt. Washington the prevailing wind was NW. and the maximum velocity NW. 60, on the 2nd; maximum velocities of 50 miles or more occurred as follows: 10th, 20th, 23rd, 25th, 28th and 29th, NW. 50; 24th, W. 52. On Pike's Peak, the total movement was 8,445, prevailing direction SW., maximum velocity 64 SW. Maximum velocities exceeding 50 miles were reported as follows: Indianola, 64 NE. 13th; Cedar Keys, 64 NE. on the 30th; Yankton, 56 SW. on the 16th and Kittyhawk on the 12th; Punta Rasa, 56 SW. on the 29th, and 56 (72 miles for 5 minutes) S. on the 30th; Brownsville, Tex., 48 miles on the 12th, when anemometer was blown down; exact maximum unknown.

Total Movements of the Air.—The following are the *largest* total movements in the various districts: Mt. Washington (summit of), 18,692 miles; North Platte, 11,167; Cape Lookout, 11,104; Chincoteague, Va., 10,238; San Francisco, 8,855; Indianola, 8,591; Pike's Peak (summit of), 8,445;

Sandy Hook, 8,216; Punta Rassa, 8,117; Milwaukee, 8,064; Sandusky, 8,010; Wood's Holl, 7,953. The *smallest* are: La Mesilla, 1,138; Lynchburg, 1,523; Red Bluff, 1,777; Augusta, 1,966; Des Moines, 2,219; Mobile, 2,305; Olympia, 2,378; Morgantown, 2,653.

Local Storms.—West Randolph, Vt., on the 12th, violent hail-storm, with wind and heavy rain, width, $1\frac{1}{2}$ miles; stones as big as butternuts; over 2,000 lights of glass destroyed. Versailles, Ohio, on the 12th, very destructive hail-storm, seriously injuring tobacco and other crops. 18th, violent tornado, 14 miles SW. of Fargo, Dak.; track two miles wide, extending across the southern part of Cass county; one man killed, three severely injured, many houses blown down. August 24th, violent local storm one mile wide and seven miles long, swept over Great Neck, Little Neck and Creedmoor, Long Island, damaging many buildings and injuring crops. In addition to the damage done by the cyclone at and near Brownsville, 12th and 13th, the following are reported: San Diego, Tex., many buildings unroofed; at Collins and Banquete, railway bridges damaged; Goliad, Tex., great damage to buildings. Ft. Mojave, Ariz., 22nd, most violent storm, barracks blown down, four men killed and five wounded.

Waterspouts.—Near Hat Creek, Wy., on the 29th, 2 p. m., moved from N. to S. for ten minutes in a zig-zag course. Red Canon, Dak., during night of 28th, destroying telegraph line for eleven miles.

Sand-storms.—Tuscon, Ariz., 3rd; Florence, Ariz., 9th; Winnemucca, Nev., 4th, 10th, 23rd, 28th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for August, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 84.8 per cent. The percentages for the four elements are: Weather, 91.0; Direction of the Wind, 78.1; Temperature, 86.8; Barometer, 82.7 per cent. By geographical districts they are: for New England, 86.0; Middle States, 86.7; South Atlantic States, 99.4; Eastern Gulf States, 84.9; Western Gulf States, 89.2; Lower Lake region, 87.1; Upper Lake region, 84.6; Tennessee and the Ohio valley, 85.0; Upper Mississippi valley, 77.4; Lower Missouri valley, 76.0; Northern Pacific coast region, 87.5; Central Pacific coast region, 100.0; Southern Pacific coast region, 94.6. There were 35 omissions to predict out of 3,813, or 0.92 per cent. Of the 3,778 predictions that have been made, 144, or 3.81 per cent. are considered to have entirely failed; 117, or 3.10 per cent. were one-fourth verified; 449, or 11.88 per cent. were one-half verified; 469, or 12.42 per cent. were three-fourths verified; 2,599, or 68.79 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—115 Cautionary Signals were displayed during the month, of which 87, or 75.7 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station. 9 Off-shore Signals were displayed, of which 6 or 66.7 per cent. were fully justified, and 9 or 100 per cent. justified as to direction. Three of the Off-Shore were changed from Cautionary. 124 Signals of both kinds were displayed, of which 93 or 75 per cent. were fully justified. 64 cases of winds of 25 miles and over per hour, from scattered stations, were reported, for which signals had not been ordered. The above does not include signals ordered for 49 display stations, where the velocity is only estimated.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as recorded on the Signal Service river gauges, during August, 1880. The rivers have continued *low* throughout the month, and, except the Ohio and its tributaries, have gradually fallen. The highest waters in the Ohio, Tennessee and Monongahela occurred between the 21st and 28th.

High Tides.—Kittyhawk, 25th, 26th and 27th, unusually high tides, tremendous swell from the east. Galveston, 12th and 13th, very high.

Low Tides.—Cedar Keys, 29th.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service Stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. II. At the following stations observations were not made on the dates indicated: Cleveland, 23rd to 29th, inclusive; Detroit, 4th to 10th; Key West, 15th to 31st; Milwaukee, 2nd to 11th; New London, 1st to 8th; Norfolk, 14th to 20th; Wilmington, 3rd to 8th; San Francisco, on the 1st.

The following were received too late to appear in the table. Punta Rassa, maximum, 89°; minimum, 78°; average depth, 13 feet. Cedar Keys, 87°, 74° and 14 feet.

ATMOSPHERIC ELECTRICITY.

Thunder-storms have been reported in too great numbers to permit their enumeration in detail, they have occurred, with greatest frequency, as follows: *Georgia*: 23rd to 25th. *Illinois*: on 23rd, 27th and 31st. *Indiana*: on 2nd, 10th, 20th, 28th to 30th. *Iowa*: 1st, 16th, 17th, 19th, 23rd, 26th and 27th. *Kansas*: 1st, 2nd, 4th, 20th, 24th, 25th, 27th to 31st. *Louisiana*: 8th and 13th. *Maine*: 21st. *Maryland*: 25th and 29th. *Massachusetts*: 12th, 21st, 25th and 29th. *Michigan*: 1st, 9th,

10th, 24th and 27th. *New York*: 2nd, 10th, 24th, 25th, 27th to 29th. *North Carolina*: 11th and 12th. *Ohio*: 2nd, 10th, 11th, 14th, 17th, 19th, 20th, 25th, 29th to 31st. *New Jersey*: 3rd, 11th, 12th, 24th, 25th, 28th and 31st. *Nebraska*: 16th, 23rd, 24th and 26th. *Missouri*: 1st, 16th and 31st. *Texas*: 16th and 17th. *Pennsylvania*: 2nd, 11th, 19th, 24th, 25th, 28th and 29th. *Tennessee*: 21st, 23rd and 27th. *Vermont*: 2nd, 9th, 20th, 24th and 28th. *Virginia*: 3rd and 10th. *West Virginia*: 28th and 29th. *Wisconsin*: 1st, 26th, 27th and 31st. On the Pacific coast, a thunder-storm occurred at San Diego, violent on the 17th, at Portland, Or., 17th, and near Dayton on the 2nd; lightning was observed at Red Bluff, Cal., on the 28th.

Auroras.—Auroras during August, 1880, have been frequent, and during the 12th and 13th, were of remarkable brilliancy, as well as wide-spread. The following displays, either isolated or covering a slight extent of country, occurred, namely: on the 1st, at Burlington, Vt., Mt. Washington, Bismarck, Pembina, New London; 2nd, at Bismarck and Pembina; 3rd, at Fort Buford and Pembina; 4th, Forts Buford and Stevenson, Pembina, Burlington, Vt. and Newport, Vt.; 6th, Fort Stevenson, Pembina, Mt. Washington, Newport, Vt., Gardiner, Me., Oswego; 7th, Des Moines, Pembina, Fort Buford, Harvard University, North Argyle, N. Y.; 8th, Pembina and Burlington, Vt.; 9th, at New Windsor, Ill.; 10th, Clinton, Ia., New Windsor, Ill. and at Harvard University; 14th, at Helena, Mont., Cornish and Gardiner, Me.; 15th, Deckertown, N. J.; 16th, Newport, R. I.; 21st, Newport, Vt.; 22nd, Harvard University; 27th, Pembina; 28th, Pembina and Wellsboro, Pa.; 29th, Wellsboro, Pa., and Newport, Vt. One aurora was observed on the Pacific coast at Umatilla, Or., on the 31st, from 9 to 11 p. m.; solid arch of light without beams; altitude 20°; color pale white.

On the 5th, a general display occurred north of latitude 42°, which was reported from thirteen stations, extending from Gardiner, Me., westward to Fort Stevenson, Dak. The most southerly stations reporting were Buffalo and Thatcher's Island.

On the 12th and 13th a most remarkable and wide-spread aurora occurred. This aurora was observed at about one hundred stations, extending from Eastport, Me., to Bismarck on the 12th and Pembina on the 13th, westward of which point the heavens were obscured. The most southerly stations reporting on the 12th were Delaware Breakwater, Fort Whipple, Va., Jacksonburg, O., Springfield, Ill., and Independence, Mo., and on the 13th, Woodstock, Md., Spiceland, Ind., and Independence, Mo.. The detail of these two displays is omitted for lack of space. While neither arch nor segment was seen at many stations, the following were its most general characteristics: dark segment varying from 50° to 30° altitude; bright arch varying from 10° to 45° altitude; brilliancy intermittent; merry dancers, at many stations, in large numbers, while at others, few or no streamers appeared; motionless at a few stations, but generally a lateral motion of varying rapidity; at some stations waves of nebulous light rose in succession to near the zenith and then faded away, while at other stations white masses moved in all directions with undulatory motion; at one station the beams, silvery white, had a tremulous motion resembling ripened grain moved by a light breeze. At several stations coronas, more or less perfect, were seen with streamers extending far beyond the zenith. Color, variously on the 12th, white, silvery white, white changing to uniform green, red and white, straw color, light yellow, pinkish white and bluish white; 13th, white, silvery white, light gray, light yellow, yellow and crimson, yellow changing to purple, pale blue.

On the 26th an aurora was generally visible in New England, while the heavens were obscured in the Lower Lake region. It was reported from six stations, Deckertown, N. J., being the most southerly.

On the 31st a display occurred, probably extending from Orono, Me., to Bismarck. During that evening the heavens, in the Lake region, were generally obscured. The most southerly stations reporting, were: Harvard University in New England, and Breckenridge in the Northwest.

MISCELLANEOUS PHENOMENA.

Earthquakes.—San Diego, 29th, 1:10 p. m., slight. Barrington, N. H., 21st.

Mirage.—New London, 11th. Delaware Breakwater, 21st.

Forest and Prairie Fires.—Portland, Or., forest fires in vicinity from 1st to 29th, when extinguished by rains. Fort Gibson, 28th, prairie fires.

Zodiacal Light.—Yates Center, Kan., 3rd, 6th, 7th, 9th; Harvard University, Mass., 7th, 8th, 9th; Nashville, Tenn., 4th, 7th, 25th, 26th; Havana, Cuba, 6th, 23rd to 28th inc.

Halos.—But few solar and lunar halos have been reported during the month. The following lunar rainbows have been reported: Leavenworth, Kan., 17th. San Antonio, Tex., 12th, showing colors distinctly.

Locusts.—Dayton, W. T., myriads from 5th to 31st, direction of movement uncertain; garden truck damaged. Pomeroy, W. T., 1st, myriads moving SW. Pike's Peak on summit, 6th, moving west; 16th, near timber line, moving west.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 144 stations show 4,441 observations to have been made, of which 29 were reported doubtful; of the remainder, 4,412, or 84.4 per cent. were followed by the expected weather.

Meteors.—A large number of stations report many meteors from the 10th to the 15th. The following only are of interest: Albany, Or., the night of the 13th and 14th, unusual meteoric display, brightest since 1833. Louisville, Ky., 6th, very brilliant meteor at 10 p. m., moved from E. to W. with widening trail and increasing brilliancy; duration 3 minutes. Chattanooga on the 10th, leaving trail of yellow light. Visalia, Cal., on the 7th, brilliant meteor, size of orange, visible 15 seconds. Little Rock, Ark., 9:39 p. m., brilliant, moved from E. to W., color, pale yellow, left trail of 10° .

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

DATE— August, 1880.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
7th, 9 a. m....	2	23†			1	3	3	23†	One of the spots very large.
8th, 12 m....	1	2	0	0	1	2	4	25;	Faculae. One of the spots very large.
9th, 5 p. m....	1	7	0	0	1	2	5	32†	
10th, 5 p. m....	0	0	0	0	0	0	5	24†	
12th, 5 p. m....	0	0	0	0	0	0	5	30†	Four of the spots very large.
13th, 5 p. m....	0	10	1	4	0	0	4	36†	Faculae.
14th, 5 p. m....	1	4	0	0	0	0	5	40†	
15th, 4 p. m....	0	0	0	0	0	0	5	40†	
16th, 9 a. m....	0	10	0	0	0	0	5	5†	
20th, 5 p. m....	2	5	3	15	1	4	4	40†	Faculae. Spots probably disappeared by solar rotation.
21st, 5 a. m....	0	0	0	5	0	0	3	30	Faculae.
22nd, 10 a. m....	0	0	1	3	0	0	2	25	Faculae.
23rd, 5 p. m....	0	0	0	15	0	0	2	10	Faculae.
24th, 4 p. m....	0	0	1	5	0	0	1	5	
27th, 8 a. m....	1	5	0	0	0	0	2	10	Spots all small.
28th, 9 a. m....	1	8	0	0	1	5	3	18	Faculae. Many of the spots small.
29th, 1 p. m....	0	8	0	0	0	0	2	20	Faculae.
30th, 8 a. m....	0	0	0	0	0	0	2	20	

†Approximated

Mr. Wm. Dawson, at Spiceland, Ind., reports: 1st, 1 group, 5 spots; 2nd, 1 group, 20 spots; 3rd, 1 group, 35 spots; 4th, 1 group, 25 (?) spots; 5th, 1 group, 25 spots, one spot *seen with naked eye*; 6th, 2 groups, 57 spots, large spot near centre *seen with naked eye*; 7th, 4 groups, 46 spots; 8th, 5 groups, 59 spots; 9th, 5 groups, 33 spots, large spot broken in two; 10th and 11th, 4 groups, 33 spots, large spot united on latter date; 12th, 4 groups, 37 spots, large spot very near W. edge; 13th, 5 groups, 57 spots, new group at E. edge; 14th, 4 groups, 60 spots; 15th, 5 groups, 81 spots, 50 spots in 1 group; 17th, 5 groups, 60 spots; 18th, 4 groups, 55 spots; 19th, 4 groups, 57 spots; 20th, 4 groups, 35 spots, 1 group disappeared by rotation, 1 new group; 21st, 2 groups, 29 spots; 22nd, 2 groups, 46 spots; 23d, 3 groups, 42 spots, large group disappearing; 24th, 2 groups, 9 spots, small group disappearing; 25th, 1 group, 8 spots; 26th, 1 group, 3 spots; 27th, 2 groups, 16 spots, new group 4' E. of centre; 28th, 3 groups, 19 spots, new group at E. edge; 29th, 3 groups, 27 spots; 30th, 2 groups, 20 (?) spots; 31st, 2 groups, 19 spots.

Mr. L. Trowbridge at Waterburg, N. Y., Aug. 1st, group near E. margin appeared by rotation, 1 large spot; 2nd, same group, with 2 spots; 5th, 4 spots, 1 large; 6th, 7 spots, 1 large, with a well defined rectangular umbra; 7th new groups visible, old probably broken, had 6 spots; 9th, old group, 5 spots, new, 1 spot, with a new group further E., all these S. of equator, north of equator, new group near E. margin, all the above appeared by rotation; 10th, 3 groups S. of equator; 11th, 4 groups, 5 spots, same as 9th; 12th, 4 groups; 13th, 4 groups, W. group disappeared by rotation and new one appeared E. of N. group; 14th, 1 new group, 5 groups of 7 spots; 15th, 5 groups, 8 spots; 16th, 5 groups, 11 spots; 17th, 5 groups, 1 with 9 spots; 21st and 22nd, 2 groups near W margin; 23rd, all disappeared by rotation; 24th, 1 faint spot near middle of disk S; 28th, 1 group, 1 spot near E. margin; 29th, 2 groups, 1 new, near W. margin.

Norwalk, Ohio, Mr. C. M. Wilcox, observer, seen daily, except 1st, 25th, 26th, 27th. Morrison, Ill., Mr. Maxwell, observer, 9th, 5 large spots.

NOTES AND EXTRACTS.

The following extracts are from a memoir on *La Lumière Zodiacale*, by P. Marc Dechevrens, S. J., who has made at Zi-Ka-Wei, near Shanghai, China, regular observations of the zodiacal light from September 1st, 1875, to September 1st, 1879:

"The observatory stands in the middle of an immense plain about twenty-five miles from the sea, and in no direction is its horizon broken by the slightest inequality of the country; moreover the observatory is isolated and the few neighboring buildings do not render the air impure or interfere with the most delicate astronomical observations.

GENERAL DESCRIPTION OF THE PHENOMENA.

"When its two branches (the east in morning, the west in the evening) have the same length—not exceeding 80° or 90° —the zodiacal light assumes the same shape on either side of the horizon; it is that of a lance head or of a half lens a little flattened. But when its length reaches 90° , 100° and beyond, it is rather a long band of light of a nearly constant width, whose splendor does not sensibly diminish even to its extremity, which it is frequently difficult to find among the brilliant stars. Sometimes near the horizon the band appears as it were to be enwrapped near its base in an envelope yet more luminous.

"The luminosity (*la lueur*) always appears quite steady and motionless. Its color is always pure white, like to the milky way. I have never observed those red or yellow tints, which others believe they have noticed in higher latitudes. The luminosity, or to speak more exactly, the matter which so shines in the zodiacal zone does not extend itself (*se développe*) in the plane of the ecliptic; it dominates it (*elle le domine*) in the greater part of its mass; the axis itself does not seem to be absolutely rectilinear; its median part, the nearest the sun raises itself a few degrees above the ecliptic, while the two extreme points (principally that of the eastern portion), re-curve and even rest on that plane, at times even sink slightly below it. This fact seems in accord with a certain number of the observations collected by Heis in his *Zodiacallicht-Beobachtungen*.

"The luminosity participates in the apparent diurnal motion of all the stars; this fact has been noticed by all who have observed the phenomena and is opposed to all theories which designate the terrestrial atmosphere as the place of the zodiacal light.

MORE SPECIAL DESCRIPTION OF THE PHENOMENA.

"The general features already described are not derived alone from observations made at Zi-Ka-Wei; they have been admitted by the earliest observers and are generally adopted by all savants."

The following details, undescribed as far as I know by any author, stand forth prominently in the whole series of our observations:

"The two branches of the zodiacal light, the eastern in the morning, the western in the evening, neither appear on nor disappear from the horizon, at the same time; but their maximum of elongation takes place at the same moment.

"The total duration of their appearance is six months for each branch.

"The first luminosity in the east appears in the early days of August and the last dies out at the end of January. On the western side the zodiacal light is first observed about the end of October and entirely disappears only in June.

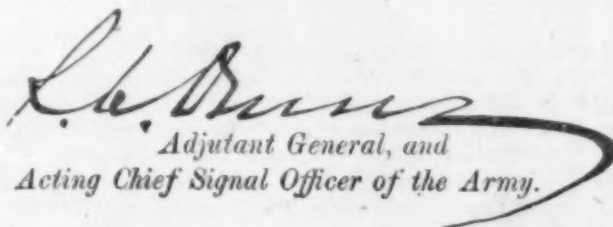
"Thus during November, December and January, in the morning before dawn and in the evening after twilight there can be viewed these two luminous bands among the stars, making in that part of the sky an angle of nearly 60° with the milky way, whose brightness and purity they rival, —especially in parts nearest the sun.

"The eastern branch (in the morning) slowly elongates from its first appearance; on the contrary the western branch (in the evening) rapidly develops and in a month can reach its maximum of elongation. Inverse phenomena prevail in its disappearance, that is to say, the morning luminosity grows faint in a short time after the epoch of its greatest elongation, while, in the evening the opposed luminosity varies very slowly and disappears almost insensibly.

"Owing to doubts expressed by savants regarding isolated observations showing an elongation of 90° and more the following, frequently confirmed by my co-adjutors, are given: 1875, November 28th (morning) 100° ; December 21st (evening) 120° ; 24th (evening) 123° ; 25th (morning) 140° ; the night of December 24th–25th, the phenomena embraced three quarters of the ecliptic. 1877, December 1st, 3rd, 4th and 7th. The band of light reached to the milky way passing between the Pleiades and Aldebaran (nearer the first stars than the latter one); then losing itself in the milky way the luminosity had yet enough brilliancy to cause us to think that it prolonged itself even to the other edge of the starry zone. The sun being then in the 251st degree of longitude the arc of the ecliptic covered by the luminous band was not less than 185° . This observation was made four times. A gap, of about 65° separated the morning and evening branches so that the total amplitude was then about 295° . The observations made by M. Eybert, in 1873, (published by Heis of Münster), during a voyage from Buenos Ayres to Cape of Good Hope agree perfectly with these. He noted December 8th (evening) in latitude 20° N. an elongation of 184° , and (morning) the other branch showed an elongation of 176° , so at that time the whole ecliptic was covered by the luminous bands.

"As to the brightness of the two branches, the maximum—not coinciding with the greatest elongation—was observed in November for the eastern and in February for the western branch."

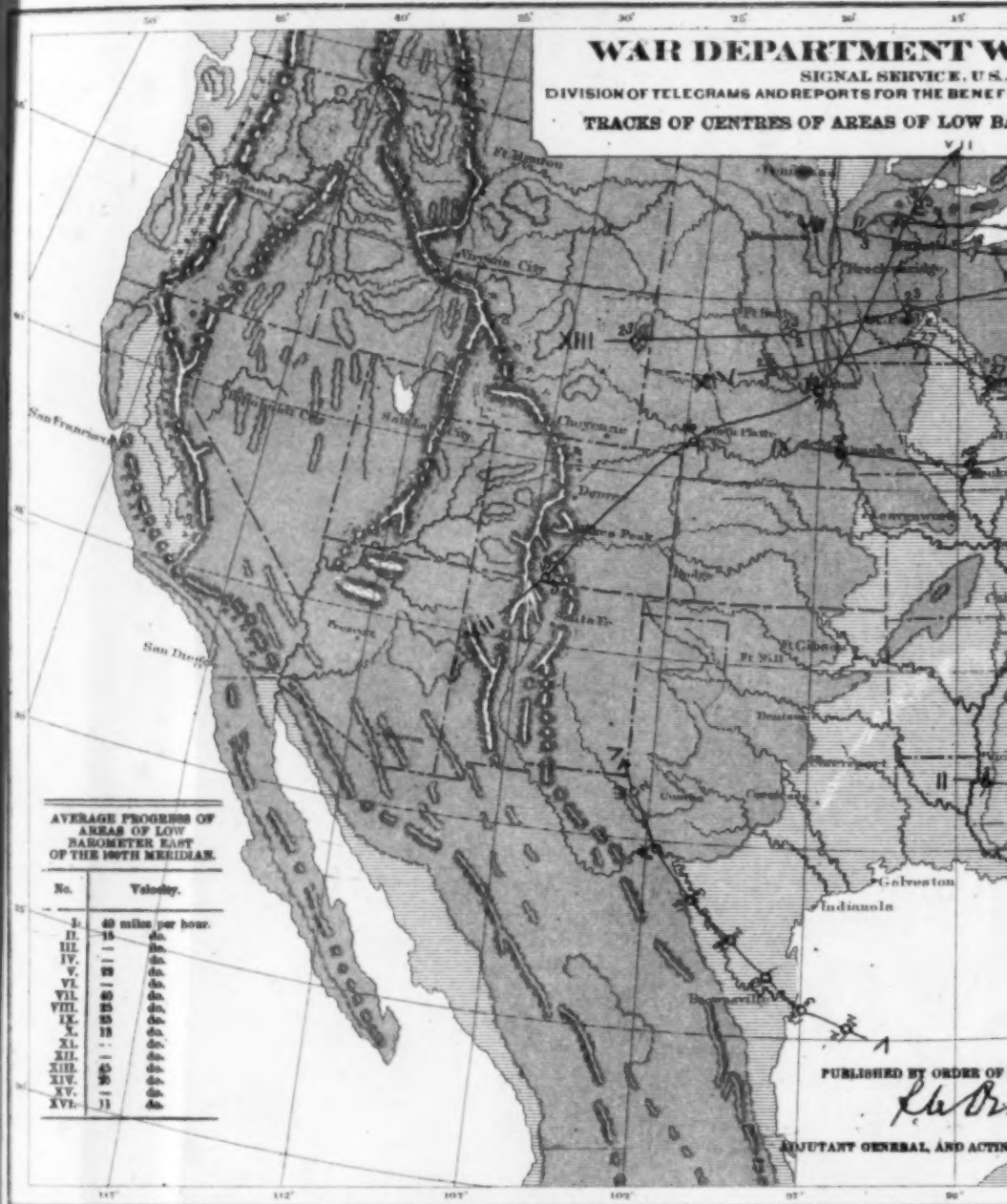
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.


Adjutant General, and
Acting Chief Signal Officer of the Army.

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ST WEATHER MAP.

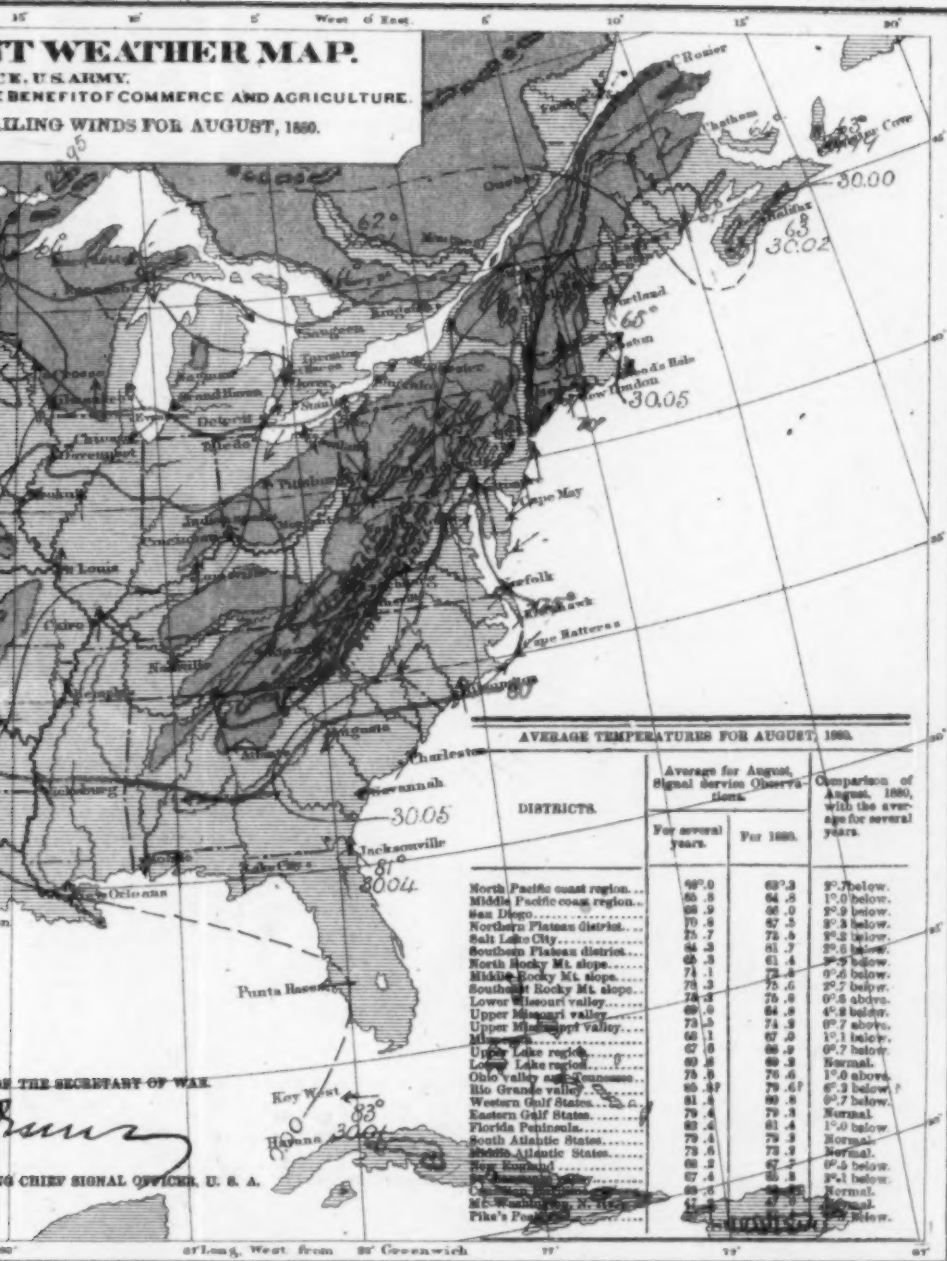
ICE, U.S. ARMY.
THE BENEFIT OF COMMERCE AND AGRICULTURE.
LOW BAROMETER FOR AUGUST, 1880.





WEATHER MAP.

U. S. ARMY.
 BENEFIT OF COMMERCE AND AGRICULTURE.
 WINDS FOR AUGUST, 1880.

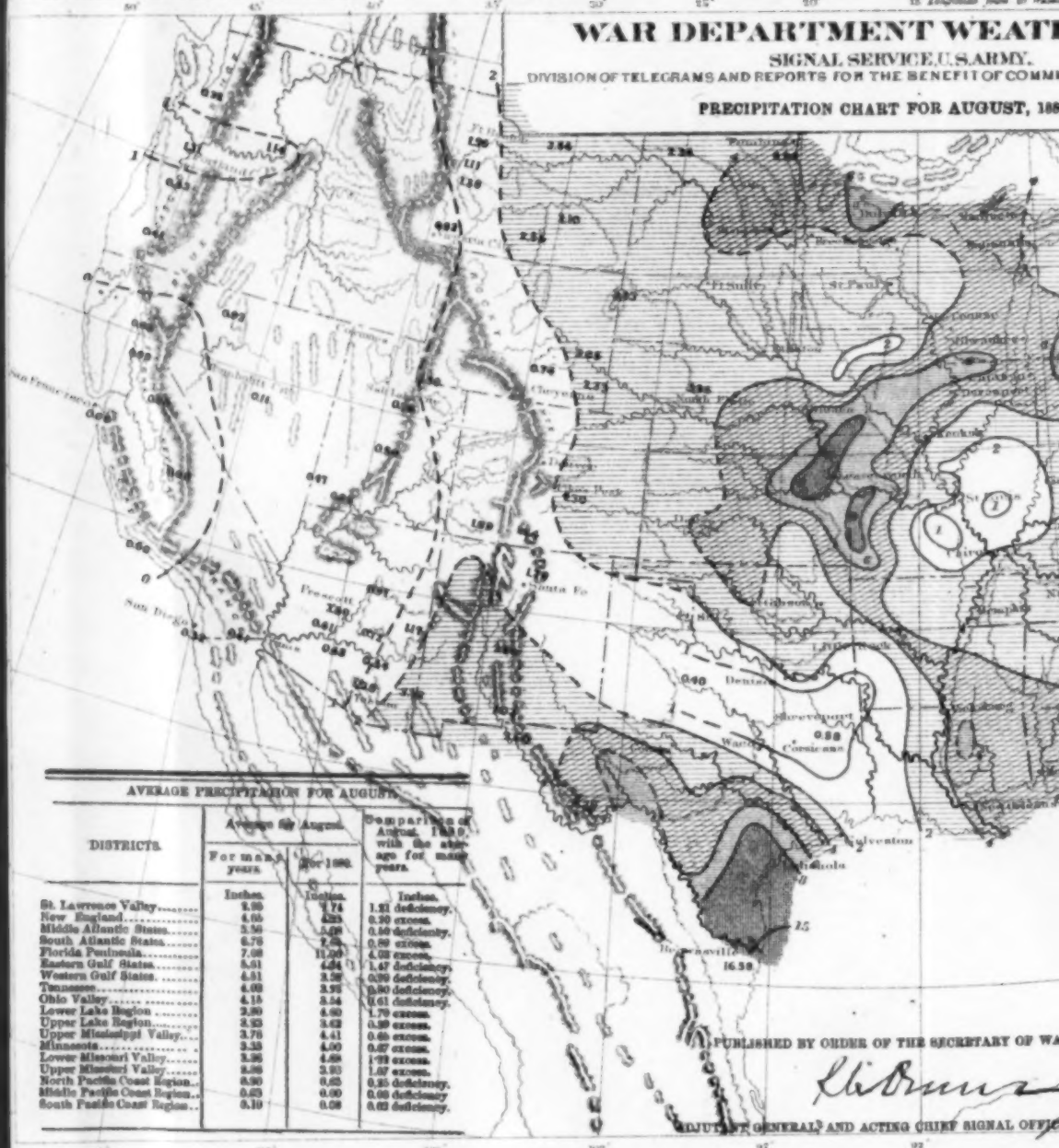


THE SECRETARY OF WAR.

CHIEF SIGNAL OFFICER, U. S. A.

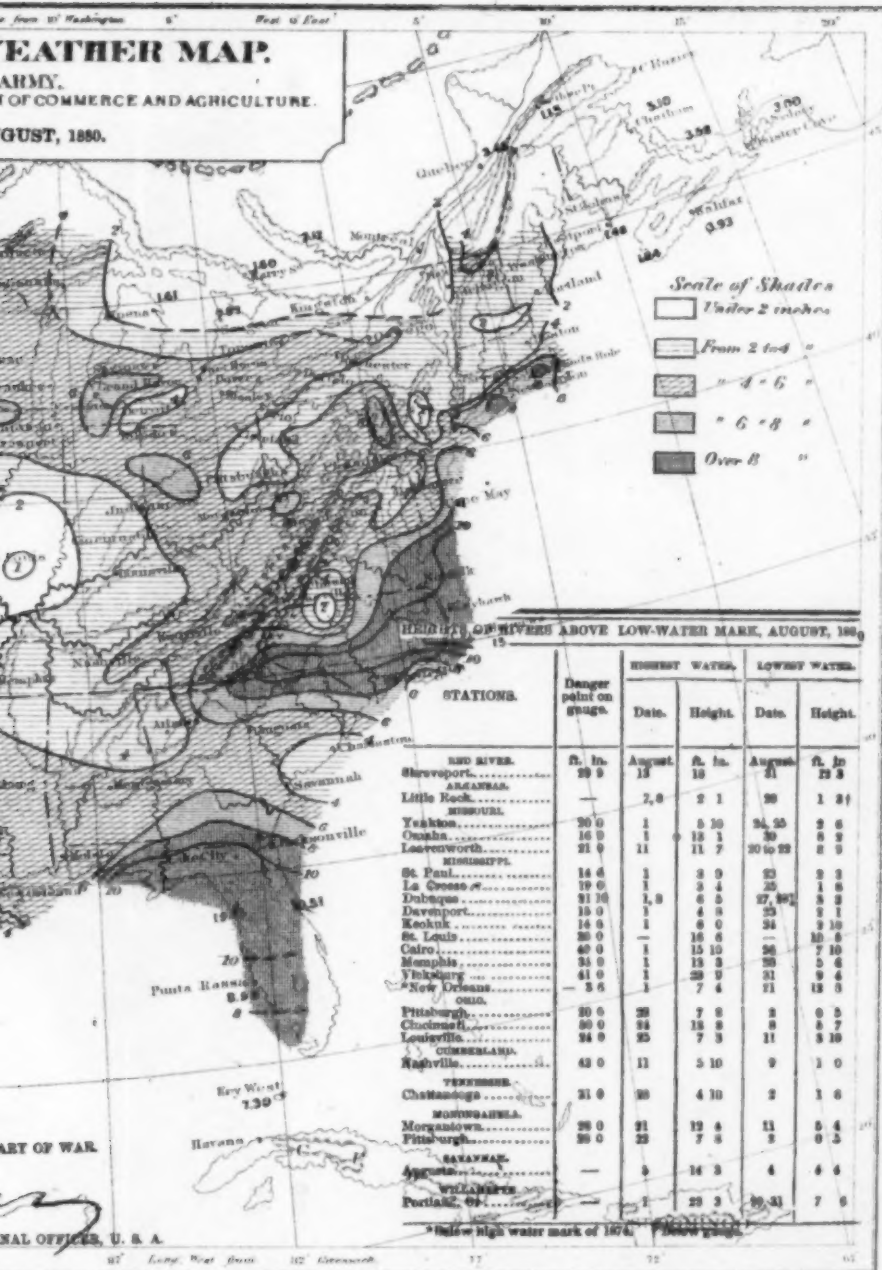
Along West from 27° Greenwich.

PRECIPITATION CHART FOR AUGUST, 1886



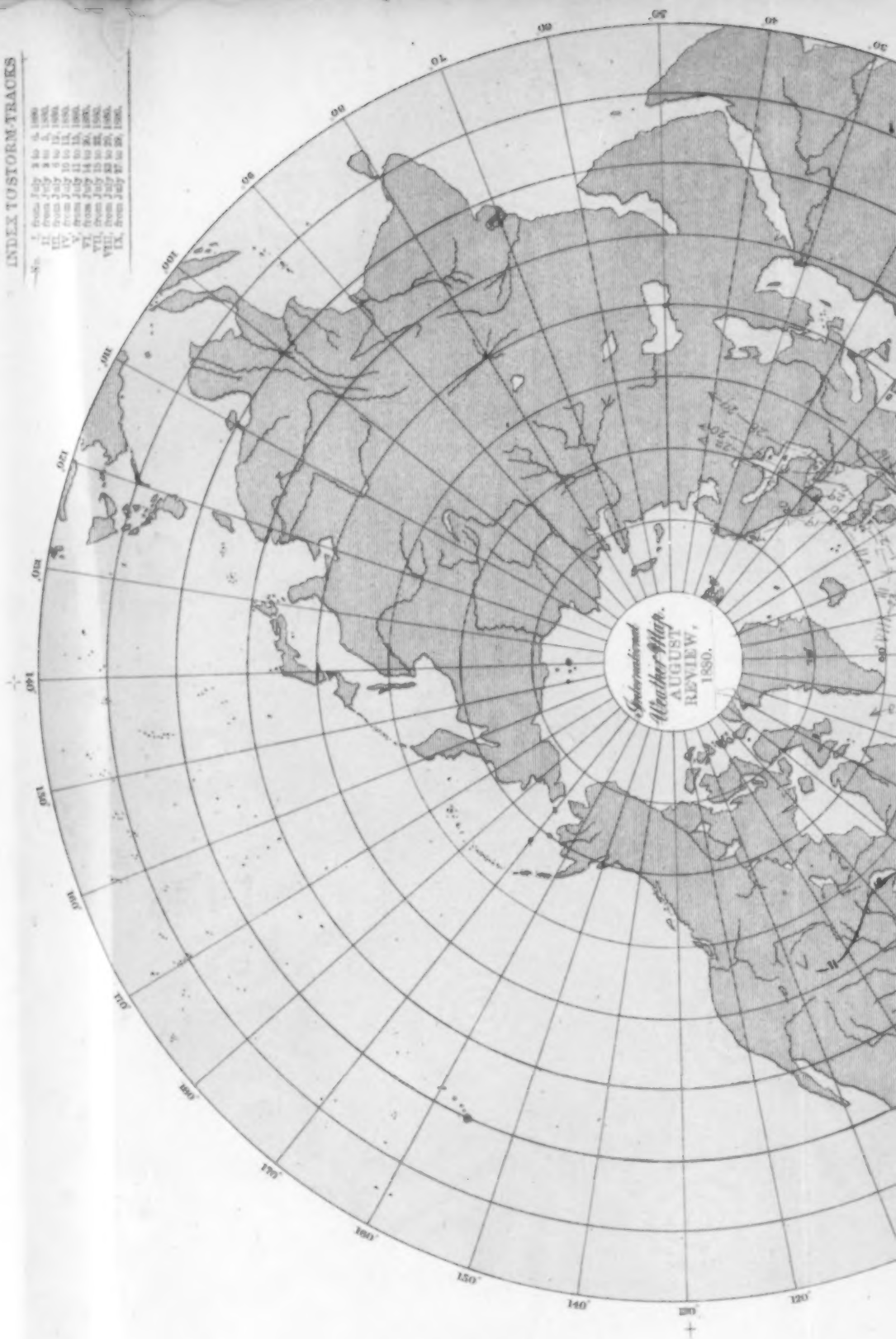
AVERAGE PRECIPITATION FOR AUGUST.			
DISTRICTS.	Average for August.		Comparison of August with the average for many years.
	For many years.	For 1900.	
	Inches.	Inches.	Inches.
St. Lawrence Valley.....	3.80	3.74	1.81 deficiency.
New England.....	4.00	3.80	2.00 deficiency.
Middle Atlantic States.....	3.50	3.00	0.50 deficiency.
South Atlantic States.....	6.75	7.25	0.50 excess.
Florida Peninsula.....	7.00	11.00	4.00 excess.
Eastern Gulf States.....	5.81	4.84	1.47 deficiency.
Western Gulf States.....	5.00	3.50	0.90 deficiency.
Tennessee.....	4.00	3.95	0.80 deficiency.
Ohio Valley.....	4.15	3.54	0.61 deficiency.
Lower Lake Region.....	3.00	3.00	1.70 excess.
Upper Lake Region.....	3.35	3.43	0.50 excess.
Upper Mississippi Valley.....	3.15	3.41	0.46 excess.
Minnesota.....	3.35	4.00	0.27 excess.
Lower Missouri Valley.....	3.30	3.68	1.79 excess.
Upper Missouri Valley.....	3.00	3.81	1.07 excess.
North Pacific Coast Region.....	8.30	6.60	0.25 deficiency.
North Pacific Coast Region.....	0.65	0.90	0.25 deficiency.
South Pacific Coast Region.....	3.10	0.08	0.03 deficiency.

No. III.



INDEX TO STORM-TRACKS

I.	From July 3 to 5, 1880.
II.	From July 6 to 12, 1880.
III.	From July 13 to 19, 1880.
IV.	From July 20 to 26, 1880.
V.	From July 27 to 31, 1880.
VI.	From August 1 to 7, 1880.
VII.	From August 8 to 14, 1880.
VIII.	From August 15 to 21, 1880.
IX.	From August 22 to 28, 1880.





INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Raymond M. ...
 BRIG. GEN. (RET.) ASST. CHIEF SIGNAL OFFICER U. S. A.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Reviews*.

UNITED STATES ARMY.

UNITED STATES ARMY.
Charted from Actual Observations taken Simultaneously. Series commencing September, 1937.

No. V.





PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
↑	1, 2	0 to 9	0 to 4.0
↑↑	3, 4	9.1 to 22.5	4.1 to 10.1
↑↑↑	5, 6	22.6 to 40.5	10.1 to 18.1
↑↑↑↑	7, 8	40.6 to 67.5	18.1 to 30.2
↑↑↑↑↑	9, 10	67.6 up.	30.2 & over.

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Auth. Inq.

BRIG. GEN. (REV. ARMS'D) CHIEF SIGNAL OFFICER, U. S. A.

ISOBARS AND ISOTHERMS.

Iso-bars in blue; detached barometer means in English inches.

Iso-therms in red; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of December, 1878, based on the daily charts of the International Bulletin.

No. VI.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing October, 1878.





PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert H. Meyer

BRIG. GEN. (BVT. ARMD.) CHIEF SIGNAL OFFICER, U. S. A.

Storm-tracks in Black. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.
Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for
December, 1878.